





Workeſhire Philoſophical Society.

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ANNUAL REPORT

FOR

MDCCCXC.

S. 403. A. 7.



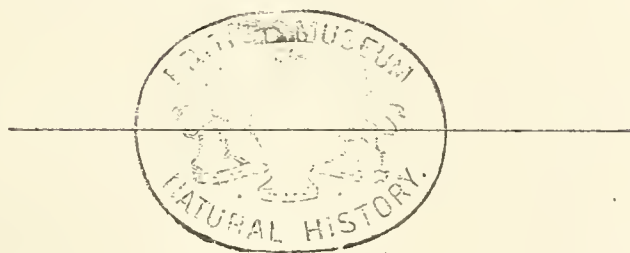
ANNUAL REPORT  
OF THE COUNCIL  
OF THE  
YORKSHIRE  
PHILOSOPHICAL SOCIETY

FOR

MDCCCXC.

PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 3RD, 1891.



YORK:  
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1891.





TRUSTEES  
OF  
THE YORKSHIRE MUSEUM,

APPOINTED BY ROYAL GRANT.

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TEMPEST ANDERSON, M.D.

EDWIN GRAY.

WILLIAM LAWTON.

F. L. MAWDESLEY.

T. S. NOBLE.

S. W. NORTH.

REV. CANON RAINE, D.C.L.

WILLIAM WALKER.

PATRONESSES

OF THE

Yorkshire Philosophical Society.

HER MAJESTY THE QUEEN.

H. R. H. THE PRINCESS OF WALES.

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PATRONS.

H. R. H. THE PRINCE OF WALES, K.G.

H. R. H. THE DUKE OF CONNAUGHT, K.G.



# OFFICERS OF THE SOCIETY, 1891

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## PRESIDENT :

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## VICE-PRESIDENTS :

THE RIGHT HON. LORD LONDESBOROUGH.

THE HON. PAYAN DAWNAY.

THE VERY REV. THE DEAN OF YORK.

THE REV. CANON RAINE, M.A., D.C.L.

WILLIAM REED, F.G.S.

JOHN FRANCIS WALKER, M.A., F.L.S., F.G.S., F.C.S. (London  
and Berlin), F.Z.S.

WILLIAM WALKER, F.G.S.

S. W. NORTH, F.G.S.

TEMPEST ANDERSON, M.D., B.Sc., &c., Fellow of University  
College, London.

THE REV. W. C. HEY, M.A.

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## HON. TREASURER :

EDWIN GRAY, LL.M.

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## COUNCIL :

*Elected 1889.* THE REV. JOHN HEY.

DR. BAKER.

RICHARD PEARSON.

FREDERICK SHANN.

*Elected 1890.* MAJOR BARSTOW.

J. E. CLARK, B.A., B.Sc.

F. L. MAWDESLEY.

*Elected 1891.* JAMES BACKHOUSE, F.Z.S.

ANTHONY BUCKLE, B.A.

JAMES MELROSE, J.P.

J. W. PROCTER.

G. S. GIBB (for two years).

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## HON. SECRETARY :

T. S. NOBLE, F.G.S.

## CURATORS :

GEOLOGY	- - - - -	W. REED, F.G.S.
MINERALOGY	- - - - -	W. H. HUDLESTON, M.A., F.R.S.
INSECTS AND CRUSTACEA	- -	G. C. DENNIS.
COMPARATIVE ANATOMY	- -	T. ANDERSON, M.D.
ORNITHOLOGY	- - - - -	J. BACKHOUSE, F.Z.S., M.B.O.U.
ANTIQUARIAN DEPARTMENT..	{	REV. W. GREENWELL, D.C.L., F.R.S. REV. CANON RAINE, D.C.L.
BOTANY	- - - - -	
CONCHOLOGY	- - - - -	REV. W. C. HEY, M.A.
OBSERVATORY	- - - - -	T. S. NOBLE, F.G.S.
METEOROLOGY	- - - - -	J. E. CLARK, B.A., B.Sc.
LABORATORY	- - - - -	J. F. WALKER, M.A., F.I.C., F.C.S., London & Berlin.
LIBRARY	- - - - -	REV. JOHN HEY, M.A.,

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KEEPER OF THE MUSEUM :

HENRY MAURICE PLATNAUER, A.R.S.M., B.Sc.

**Vote of Condolence to Mrs. Thomson, on  
the death of the Archbishop of York,**

**ADOPTED AT THE ANNUAL MEETING OF THE YORKSHIRE  
PHILOSOPHICAL SOCIETY, 3RD FEBRUARY, 1891.**

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“The Members of the Yorkshire Philosophical Society, in their Annual Meeting assembled, desire to convey to Mrs. Thomson and her family the fullest and the most earnest expression of their sympathy and regard. The late Archbishop of York was the President of the Society for a quarter of a century, and it will be a comfort to Mrs. Thomson and her family to know how glad the Members were to be under his presidency, how greatly they admired his varied gifts and acquirements, and how keen is their regret at losing him.”

*Signed on behalf of the Meeting,*

**JOHN FRANCIS WALKER,**

**CHAIRMAN.**





REPORT OF THE COUNCIL  
OF THE  
YORKSHIRE PHILOSOPHICAL SOCIETY,  
FEBRUARY 3RD, 1891.

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The Council of the Yorkshire Philosophical Society have now the pleasure to submit to the members their Report for the year 1890.

The Balance Sheet, which will be referred to more in detail at the close of the Report by the Treasurer, and which has been audited by Mr. Cunninghame of the Yorkshire Insurance Company, is highly satisfactory. The Income of the Society for the year is upwards of £40 in excess of the Income of the previous year. The Expenditure, including the large payment of £198 5s. 2d. on account of the mortgage debt and interest due to the Insurance Company, amounts to £1271 6s. 0d., leaving a balance in the Treasurer's hands of £30 17s. 6d.; a more favorable result than has been shewn on any Balance Sheet presented to this Society for many years past. The items of Receipt and Expenditure will be more particularly referred to by the Treasurer before the close of the Meeting. The Report will now follow the usual course and present in detail the state of the various Scientific Departments of the Society.

GEOLOGY.—The additions made in this department during the past year have not been either numerous or important. The most noteworthy are a skull of a Steneosaur from the Lias of Whitby, presented by the Honorary Curator, and a small collection of plants from the Coal Measures of the Barnsley District, presented by the Trustees of the Cawthorne Museum through the Rev. C. T. Pratt. But even with this addition, our series of Yorkshire Coal Fossils is very imperfect.

The Honorary Curator notes with much pleasure the increasing use made of the Palæontological Collections by specialists. Specimens of our Pliocene Mammals have been sent for examination to Mr. E. T. Newton, Mr. A. S. Woodward has examined some of our Carboniferous Fishes, Mr. Crick some of our Jurassic and Neocomian Belemnites, Mr. Bather some Silurian Crinoids, Mr. Gregory our Pliocene Echinoidea, and Professor Pavlow (of Moscow) our Yorkshire Neocomian Cephalopods. The work thus done on our Collections by skilled investigators is of twofold value, for not only is Science thereby advanced, but we ourselves benefit by having our specimens accurately named by competent authorities.

ANTIQUITIES.—The Curator is happy to be able to report the continued extension of the many and varied objects under his charge. The number of antiquities obtained from York itself is, perhaps, below the average, as the use of concrete has practically put an end to deep digging, but the influx of curiosities increases rather than otherwise, and the want of space will soon become a very serious matter. The Curator is just finishing a new edition of the catalogue which will be at least one-third larger than its predecessor, and bears strong testimony to the rapid growth of the collections in the Department. The Curator desires to make special reference to a very interesting sculptured slab from Babastis, which has been kindly purchased and presented to the Museum by some of our York members, and to two fine gold rings of Roman work, both of them found in York, which have been given to us by Mr. R. Smith of Scarborough.

MINERALOGY.—The chief work in the department of Mineralogy during the past year has been the exhibition and arrangement of a Rock Collection. It will be remembered that a long case, containing shells, used to rest on the top of the Mineral Cabinet. A series of rock specimens now replaces the shells, and, as the case itself has been fitted with glass shelves, more light is also thrown upon the minerals below. In consequence of this alteration the minerals themselves are now much better seen than was formerly the case.

We are indebted to Mr. J. F. Walker for numerous specimens both of rocks and minerals. Dr. Tempest Anderson presented a collection of rocks from Iceland, and Mrs. Ball a collection chiefly derived from the Tyrol. The above constitute the principal acquisitions in this department during the past year.

CONCHOLOGICAL DEPARTMENT.—This Department has received large additions during the past twelve months, and the Curator has endeavoured particularly to strengthen those parts of the collection which were conspicuously weak. Most of the important genera are now more or less fully represented, but there is still ample room for the judicious expenditure of a few pounds every year. Much attention has been given to the determination of unnamed specimens, and, in scores of cases, unlocalized examples have been replaced by localized.

The collection has been rendered much more useful to the student by the introduction of a number of figures of the animals, carefully executed by Mrs. Platnauer.

LIBRARY.—The Curators of the Library report that the books in the Library have been re-arranged, spaces being left for the continuation of works in progress. By the kindness of Mr. Reed, important additions have been made to the Reference Library, including several volumes of the "Challenger" Report. The only purchase of any magnitude which has been made during the year, is that of the Italian "*Annales de Géologie et de Paléontologie*." Beyond this, but little has been spent on the Library in binding; it would be well, however, if possible, to expend more another year in binding and so preserving loose numbers. The work of preparing a new catalogue has been going on, but the Rev. John Hey regrets that the distance of his residence from the Museum causes the progress to be slower than he could wish.

COMPAPATIVE ANATOMY.—The most important addition made to this department during the past year is the skeleton of a cow. The carcase was obtained by the Museum Attendant,



William Watson, who got out and cleaned the bones. The Honorary Curator of Geology, Mr. Reed, feeling how important it was that the Society should possess a well set-up bovine skeleton, had the bones sent to London where they were articulated by Mr. Gerrard. The skeleton has been mounted on a stand and placed opposite to that of "Blink Bonny." It helps to remedy that lamentable deficiency in the skeletons of our commoner Mammalia which the Honorary Curator of this department has so often pointed out. A skeleton of Bennet's Wallaby (*Halmaturus Bennetii*) presented by Mr. C. J. Naylor has also been set up and added to the collection. The same generous donor has sent us a Red Kangaroo (*Macropus rufus*), an Antelope and an American Ostrich (*Rhea Americana*). The skeleton of the Kangaroo and that of the Antelope are in course of preparation.

ENTOMOLOGY.—The Coleoptera and the Allis collection of Lepidoptera are in good order, but the exotic Lepidoptera are in a very unsatisfactory condition. The Honorary Curator hopes to be able to devote some time during the coming year to improving this part of the collection. A large number of the specimens are absolutely useless and will have to be thrown away, and the Honorary Curator expresses a hope that donations will be forthcoming to help him in filling up the gaps thus formed. He is also desirous of replacing unlocalized specimens by localized ones wherever possible.

ORNITHOLOGY.—The work of re-organizing and adding to the collection of British Birds has progressed steadily during the year and the "Strickland" Gallery is now two-thirds filled with the new cases.

Several donations have been made, among which may be mentioned a pair of Sabine's Gulls (adult and immature) shot at Flamborough and kindly presented by Canon Raine, and an immature example of the Asiatic Turtle Dove (*Turtur risorius*) shot at Scarborough in the autumn of 1889. The capture of this bird was mentioned in the "Naturalist." It is the only known British example, but it has once or twice occurred in other parts of Europe. A fine specimen of the American



Ostrich (*Rhea Americana*) has been presented by Mr. C. J. Naylor; an Apteryx (*A. Owenii*) by Miss Darley; some Humming Birds (with nests) by Captain Thomson; a small collection of skins by Mrs. Tute, and the Honorary Curator has added to the collection a Black-bellied Dipper, shot at Spurn.

The collection of eggs has received many additions, due chiefly to the energy and kindness of Canon Raine.

METEOROLOGY.—The present year completes the half-century of reports upon this subject presented to the members of the Yorkshire Philosophical Society. It is hoped that the results will be in due course worked out and utilised.

Temperature was again slightly above the average; the mean of the 9 A.M. and 9 P.M. returns is  $47.7^{\circ}$ , that of the maxima and minima  $48.2^{\circ}$ . The former is  $0.3^{\circ}$  higher, the latter  $0.35^{\circ}$  lower than last year, which leaves practically no choice between the two. The distribution of temperature has, however, been different. February, March, April, September, and October were warmer in 1890, September by as much as  $4.7^{\circ}$ . Indeed it was actually the warmest month in the year. December was  $4.2^{\circ}$  colder. Its mean,  $32.6^{\circ}$ , was the lowest in December since 1878 and 1879. 1846, 1859, and 1874 also gave colder Decembers, the last recording  $29.8^{\circ}$ . The coldest January was 1881 ( $28.3^{\circ}$ ), but the mean in February, 1855, was only  $25.9^{\circ}$ . The Februaries of that decade indeed give the coldest average ( $35.5^{\circ}$ ) for any set of months. The Januaries were coldest in the forties, sixties and eighties, the Decembers in the seventies.

Over the whole period, however, January is the coldest, December coming next.

The absolute extremes last year were  $79.9^{\circ}$  on August 5th and  $13^{\circ}$  on December 13th. The maximum in December, 46, was lower than any since 1844 when it was  $44^{\circ}$ . But in 1842 the January maximum was  $40^{\circ}$ .

The weather charts show that a continental winter of unusual severity and extent, involved the Southern, and especially the South Eastern, parts of Britain within its sphere of action. The tracks of depressions which by crossing our island, usually

temper our winter by mild moist South-Westerly gales, were deflected to the North and West. Hence resulted such a reversal of climates that, while London experienced 29 frosts, Bodö, within the Arctic Circle on the coast of Norway, had but one, and Stornoway in the Hebrides, only two.

Bright Sunshine 1191 hours was again below the average, although fully 8 per cent. better than last year. December was the most sunless of our ten years' record, giving but one hour against an average for the ten years of  $24\frac{1}{2}$  hours. June however, was the chief defaulter, giving only 103 hours, the previous average having being 176 hours. The three autumn months, however, made some amends, being sunny as well as warm.

Rain or Snow fell on 187 days, the latter in noticeable quantities on 21 days only. The total, 23.93 inches is again below the mean. The heaviest fall was 0.88 on September 10th. April (0.7 inches) was the driest month, although February and December gave but little more. The summer months, June, July and August were all in excess, as was also November.

Floods were again very slight except on January 27th, when 11 feet was reached. Otherwise it never reached 6 feet. There were only six days at summer level, and none before July 24th.

The Barometer ranged from 30.698 on February 23rd to 28.682 on January 23rd, a range 0.040 in excess of last year.

The February mean was nearly half an inch above that of March. The most violent gale was that on January 19th, when signs of salt, from sea spray carried by the Western gale, were again noted, as in the previous October.

Auroras were observed on April 7th and 8th and October 10th and 17th, thus showing a slow increase in association with the similar slow growth of solar activity, as indicated by sun-spots.

Sunset glows were specially fine several times in the autumn, the most brilliant occurring upon October 27th, when cirrus clouds of a peculiarly delicate filmy gauze-like type had been visible throughout the afternoon. The sun set at 5-15 and a faint flush appeared at 5-40. By 5-50 this was orange pink



along the lower cloud edge at 20° altitude, rosy at 40° shading upwards into purple. This from 60° to the zenith, beyond which, it was then almost black, assumed the magnificent “imperial purple” hue, which was so conspicuous after the Krakatao eruption in 1883, but which has not been observed here since 1884. This lasted until 6-5 whilst the lower cloud edge was still lit up at 6-40, an indication of its vast altitude.

Henry Richardson, Esq., has again kindly supplied additional returns from Cherry Hill, York, and Cherry Bank, Ilkley, and Richard Thompson, Esq., has done the same for Oswaldkirk. At the latter place the sunshine was more than at York by 86 hours, a difference chiefly due to the winter months. This is specially noteworthy in December when fog and haze weakened the solar rays so much at York, that only one hour was recorded against 18½ on the slope at Oswaldkirk. But York only shared the fate of most larger places. In Westminster no sun was recorded for more than a month.

PHOTOGRAPHIC SECTION.—This Section now numbers forty-one Members. Meetings have been held monthly during the year, at which the attendance has been satisfactory; papers on technical subjects, as well as on the principles of art as applied to photography, have been read by the Members. Exhibitions of lantern-slides have formed a feature of special interest, and Members have had an opportunity of seeing and criticising the work of some of the best manipulators in this branch of the Art-science.

There have also been on view, on several occasions, the “Amateur Photographer” Prize Competition prints, thus enabling Members to examine the work of many photographers distributed widely throughout the United Kingdom, and so form a fairly correct estimate of the progress of photography.

A photographic survey of this City and of the immediate neighbourhood has been commenced during the year, and a considerable number of views of historical buildings, street and village scenes, have been contributed by those Members taking part in this work, thus forming a nucleus which in its growth will become more valuable by lapse of time, and remain a permanent record of the changes taking place in the district.

At the Soirée held in the Museum, the Members and other individuals contributed a very interesting and well-executed collection of photographs of landscape, architectural and figure subjects, which were exhibited in the Library and Galleries of the Museum. Many of these views were printed in platinum and other black and white processes, and showed that photography was justly entitled to rank as one of the fine Arts.

The opening address of the Winter Session was delivered by the President of the Section, Dr. T. Anderson, in the Theatre, and was thrown open to the Members of the Society in general. The subject, "Notes on a Photographic Tour in Iceland," was illustrated by lantern views prepared from negatives taken by the lecturer during a visit to that island, and strikingly depicted the scenery of the country and the salient physical features for which it is so highly celebrated.

The death of Archbishop Thomson has removed from the head of the Yorkshire Philosophical Society its President. It is not within our province to speak of the valuable official life of the late Primate, but we cannot overlook the services he has rendered to Social Science and Philosophical enquiry. His "Outlines of the Laws of Thought," which is still a text book on that interesting subject, was written whilst the author was an undergraduate at Queen's College, Oxford. Soon after he became Archbishop he became President of this Society, and took the warmest interest in its success. In 1866 he delivered and published his inaugural address, and two years afterwards he gave a lecture at Edinburgh on "The Limits of Philosophical Enquiry." We are not aware that he published anything else on these topics—his official duties almost prohibited that—but he was at all times deeply interested in social and scientific subjects, especially in the health of towns, the housing of the working classes, and in the mental as well as the moral improvement of the people. He was a Fellow of the Royal and Geographical Societies, and President of the Palestine Exploration Fund. But although the Archbishop's numerous and almost overwhelming labours precluded the possibility of his writing any large scientific work, he found his chief recreation in his library, in which almost every branch of



Science and Philosophy was represented. In addition to this, Archbishop Thomson was a practical Chemist, testing his bookwork by experiments in a laboratory, whilst in Photography he attained considerable excellence. In conjunction with many other Institutions and Public Bodies, the Yorkshire Philosophical Society has great reason to regret the loss of a President who was conspicuous for so many rare gifts and accomplishments.

We have also to regret this year the death of Mr. Edward Hailstone, a noted Archæologist and lover of Art. He had been a member of this Society for more than forty years. In his early life he resided for a time in York and was asked in 1848 to become Curator of Antiquities in conjunction with Mr. Wellbeloved, but was unable to do so. Mr. Hailstone presented to the Society the Herbarium formed by his uncle, the Rev. S. Hailstone, together with his own collection of Antiquities. He has also bequeathed to the Dean and Chapter of York his invaluable collection of books relating to Yorkshire.

The Society, by the death of Dr. Matterson, has also lost a valued member. Dr. Matterson had been from an early period in his life a member of the Yorkshire Philosophical Society, and had on several occasions given his services as a Member of the Council. For some years he was Curator of Botany; a branch of Science in which he took great interest and cultivated up to the time of his death. For some years he filled the office of a Vice-President of the Society, and died in the course of last year at an advanced age. Dr. Matterson was a supporter of other kindred Societies, especially those which had for their object the alleviation of suffering or the advancement of learning, and his death will be much felt amongst us.

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27 Members of the Society, 8 Lady Subscribers, and 1 Associate have resigned during the past year, whilst 10 Members have been lost by death. 22 New Members, 2 Life Members, 9 Lady Subscribers, 2 Associates, 3 Temporary Members, and 1 County Member have been added to the Society's list during the past year.

The Council have elected as Honorary Members:—

F. W. Rudler, F.G.S., Curator of the Musuem of Practical Geology.

E. T. Newton, F.G.S., Palæontologist to the Geological Survey.

C. J. Naylor, Esq., Kerry, Montgomeryshire.

S. S. Buckman, F.G.S.

The Council recommend for election as Vice-President, the Rev. W. C. Hey, M.A., in place of Dr. Matterson, deceased, and as New Members of Council:—Mr. J. Backhouse, Mr. A. Buckle, Mr. J. Melrose, and Mr. J. W. Procter, in the place of Sir Joseph Terry, Knight, W. W. Hargrove, Esq., R. Thompson, Esq., and Bowden Cattley, Esq., who retire by rotation; and Mr. G. S. Gibb, for two years, in the place of the Rev. W. C. Hey.

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HEIGHT OF THE RIVER OUSE DURING 1890.

Date.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.		Feet. In.	
1	Water off.		6		0	10	2		0	10	0	6	1		3		Water off.		4		1		Water off.	
2	1	2	6		0	1	0	1	1	0	0	6	4		6		"		3		0		5	
3	0	6	2		0	1	1	1	1	0	0	6	1		0		"		1		3		2	
4	1	0	6		0	0	8	2	0	8	0	10	0		0		"		0		S.L.		0	
5	1	2	6		0	0	8	2	0	7	0	9	1		7		"		0		1		1	
6	2	10	0		0	0	8	2	0	0	0	9	1		6		"		0		0		1	
7	2	10	6		0	0	7	0	0	9	0	9	0		6		"		0		2		0	
8	4	3	11		0	0	6	0	0	8	0	6	0		8		"		1		3		Water off.	
9	1	10	0		0	0	8	2	0	0	0	6	0		6		S.L.		2		0		Water off.	
10	4	4	1		0	0	1	0	0	0	0	6	0		7		0		1		0		"	
11	3	8	0		0	0	1	0	0	0	0	8	0		7		0		0		4		1	
12	1	7	2		0	0	1	0	0	0	0	7	0		10		0		0		1		Water off.	
13	1	6	2		0	0	1	0	0	0	0	7	0		2		0		0		0		"	
14	1	7	2		0	0	1	0	0	0	0	7	0		2		0		0		2		"	
15	1	10	1		0	0	1	0	0	0	0	9	0		6		0		0		2		S.L.	
16	1	3	9		0	0	1	0	0	0	0	10	0		0		S.L.		0		S.L.		Water off.	
17	1	7	0		0	0	1	0	0	0	0	7	0		6		0		1		0		"	
18	1	6	3		0	0	1	0	0	0	0	6	0		6		0		0		Water off.		"	
19	1	1	1		0	0	1	0	0	0	0	7	0		7		0		0		"		"	
20	2	2	2		0	0	2	0	0	0	0	10	0		0		0		0		"		0	
21	1	6	3		0	0	1	0	0	0	0	6	0		6		0		0		"		0	
22	1	10	2		0	0	1	0	0	0	0	6	0		10		0		0		"		0	
23	3	0	2		0	0	1	0	0	0	0	6	0		6		0		0		"		0	
24	5	0	3		0	0	1	0	0	0	0	6	0		3		1		"		0		S.L.	
25	3	0	3		0	0	0	0	0	0	0	6	0		6		0		"		1		0	
26	4	10	11		0	0	0	0	0	0	0	6	0		11		0		"		4		0	
27	10	10	1		0	0	0	0	0	0	0	6	0		6		1		"		4		10	
28	11	0	1		0	0	0	0	0	0	0	6	0		5		0		"		1		0	
29	9	0	1		0	0	0	0	0	0	0	6	0		7		0		"		0		11	
30	3	6	2		0	0	0	0	0	0	0	6	0		6		0		"		2		2	
31	3	5	0		0	0	0	0	0	0	0	6	0		2		0		0		Water off.		0	



# STATION, YORK.—THE MUSEUM.

Longitude 1° 5' W., Latitude 53° 57' N. Height above Mean Sea Level 51 feet.

1890.	Highest Barometer.	Lowest Barometer.	Mean Pressure.	Air Temperature.							Tension of Vapour.				Relative Humidity.			
				9 a.m.	9 p.m	Mean.	Means of		Absolute Min. and Max.			9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean	
							Min.	Max.	Min.	Date.	Max.							Date.
January	29th, 9 p.m. 30·365	23rd, 9 a.m. 28·682	ins. 29·786	° 40·8	° 42·9	° 41·9	° 36·5	° 48·1	° 21·1	3rd	° 57·0	25th	in. ·219	in. ·237	in. ·228	%. 87		
February	23rd, 9 p.m. ·698	15th, 9 p.m. 29·472	30·252	37·7	37·3	37·5	33·3	42·8	25·0	28th	51·0	{ 1st 3rd	·203	·199	·201	90		
March	3rd, 8 a.m., ·561	24th, 9 p.m. ·113	29·768	43·8	43·4	43·6	37·8	50·3	25·0	{ 3rd 4th	61·3	28th	·237	·243	·240	84		
April	1st, 8 a.m. ·370	7th, 8 a.m. ·326	·845	43·9	43·0	43·5	35·8	52·3	27·3	1st	60·0	30th	·221	·223	·222	79		
May	22nd, 9 a.m. ·317	11th, 9 a.m. ·391	·855	54·0	51·4	52·7	44·1	62·7	34·3	2nd	72·5	24th	·308	·305	·307	77		
June	14th, 9 p.m. ·394	30th, 9 p.m. ·118	·942	58·0	55·2	56·6	49·6	64·7	40·0	1st	72·0	{ 10th 16th	·357	·370	·364	80		
July	20th, 9 a.m. ·239	1st, 8 a.m. ·262	·854	59·2	56·5	57·9	50·5	65·8	42·6	20th	72·8	21st	·378	·374	·376	79		
August	31st, 9 p.m. ·280	26th, 9 p.m. ·299	29·849	58·4	55·1	56·8	50·1	65·8	38·0	31st	79·9	5th	·385	·369	·377	82		
September	7th, 9 a.m. ·480	22nd, 9 a.m. ·585	30·101	58·3	58·2	58·3	51·4	67·5	37·2	1st	75·6	8th	·417	·412	·415	85		
October	8th, 9 p.m. ·497	26th, 8 a.m. 29·316	30·025	49·4	48·6	49·0	42·4	56·0	25·5	28th	65·1	12th	·287	·287	·287	83		
November	20th, 8 a.m. ·404	7th, 8 a.m. 28·881	29·815	41·0	41·8	41·4	34·6	48·5	23·4	27th	57·0	{ 18th 19th 20th	·227	·242	·235	91		
December	30th, 9 a.m. 30·477	19th, 8 a.m. 29·340	30·092	32·3	32·8	32·6	28·4	35·7	13·0	22nd	46·0	4th	·168	·170	·169	91		
Year	Feb. 23rd, 30·698 9 p.m.	Jan. 23rd, 28·682 9 a.m.	29·932	48·1	47·2	47·7	41·2	55·0					·284	·286	·285	83·8		



# STATION, YORK.—THE MUSEUM.

Thermometers 4 feet 3 inches above ground. Rain-gauge 1 foot 9 inches above ground.

1890.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of							Sunshine Returns.				
	9 a.m.	9 p.m.	Mean	Total. ins.	Max. ins.	Day	Rain	Snow	Hail	Thun- der Storms	Clear Sky	Over- cast	Gale	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm	Total hours.	Per. centage 1890	Per centage. 1889.
January	6.4	4.6	5.5	2.210	.450	21st	22	4	1	0	4	5	1	2	0	1	4	25	9	19	1	1	36	15	13
February	8.9	6.6	7.8	0.770	.450	15th	8	3	0	0	0	17	0	15	2	22	4	4	2	3	3	1	46	17	22
March	7.5	6.6	7.1	1.370	.270	24th	17	3	1	2	3	14	0	6	3	3	4	10	8	21	7	0	92	25	26
April	6.1	5.4	5.8	0.760	.220	12th	9	1	0	0	4	9	0	18	2	16	6	5	2	9	2	0	143	34	23?
May	5.8	5.9	5.9	1.980	.340	10th	12	0	0	2	5	9	0	9	6	22	6	9	3	5	2	0	190	39	27
June	6.9	7.1	7.0	2.280	.770	30th	17	0	0	2	0	11	0	6	2	2	2	11	5	29	3	0	103	20	47
July	7.1	6.7	6.9	2.620	.770	16th	17	0	0	1	0	12	0	7	4	4	0	9	9	22	7	0	162	32	32
August	6.1	6.1	6.1	3.970	.880	10th	17	0	0	1	4	11	1	4	2	11	3	6	5	24	7	0	158	35	25
September	6.4	4.6	5.5	2.089	.430	21st	14	0	0	1	3	6	0	2	0	8	5	15	6	22	2	0	124	33	27
October	5.7	5.8	5.8	1.220	.290	28th	14	0	0	0	3	8	1	10	0	2	1	8	6	30	4	1	91	28	14
November	6.7	5.9	6.3	2.970	.580	23rd	25	4	0	0	2	5	0	12	4	4	4	15	1	14	4	2	45	18	17
December	8.5	8.4	8.5	0.760	.100	25th	15	6	0	0	2	20	0	7	4	24	8	13	0	0	2	4	1	0	9
Year	6.8	6.1	6.5	22.930			187	21	2	9	30	127	3	98	29	119	47	130	56	198	44	9	1191	24.7	23.5

BRIGHT SUNSHINE VALUES.—BOOTHAM SCHOOL.

[illegible]

SUPPLEMENTARY RETURNS,

SUPPLIED BY

H. RICHARDSON, ESQ., AND R. THOMPSON, ESQ.

Month.	CHERRY HILL, YORK.		CHERRY BANK, ILKLEY.		RAINFALL AT GANTON HALL, YORKSHIRE.			RAINFALL AND SUNSHINE RECORDED AT THE HERMITAGE, OSWALDKIRK.				
	Monthly Totals.	Inches.	Total Depth.	Inches.	Total Depth.	Inches.	Days on which .01 or more fell	Rainfall. Total Depth.	Greatest Fall in 24 hours.		Number of Days on which .01 or more fell	Total No. of hours of bright sunshine, and whether in excess (+) or not (-)
									Depth.	Date.		
Jan.	1.97		4.90		2.22		17	2.60	.70	21 & 25	8	43.45 +
Feb.	.71		.69		2.18	1.11	11	.99	.32	16	5	46.93 +
Mar.	1.29		3.01		1.98		17	1.99	.56	2	8	98.15 +
April	.69		1.34		0.76		12	1.06	.40	13	7	149.48 +
May	2.04		3.77		2.21		11	2.79	.83	11	5	184.50 -
June	2.39		3.73		2.73		11	2.05	.50	29 & 30	9	107.55 +
July	2.44		2.63		2.09		17	2.765	.72½	16	10	144.80 -
Aug.	3.78		6.58		3.32		17	4.09	.95	4	10	167.65 +
Sept.	1.88		2.12		2.47	1.15	11	1.42	.68	4	4	145.60 +
Oct.	1.15		1.52		1.82		9	2.09	.70	4	7	104.52 -
Nov.	2.90		4.13		3.23		18	3.71	1.54	29	6	65.65 +
Dec.	.72		.70		1.09		10	1.10	.51	27	4	18.45 +
Total	21.96		35.12		26.10		161	26.655			84	1276.73



## LECTURES.

The following Evening Lectures have been delivered in the Theatre of the Museum :—

Four Lectures on “ Contrivance in Nature,” by Prof. L. C. MIALL, Yorkshire College :

Feb.	6th.	Lecture I.	“ Leaves and Stems.”
„	13th.	„ II.	“ Flowers.”
„	20th.	„ III.	“ Defences of Animals.”
„	27th.	„ IV.	“ Eggs and their Development.”

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March	6th.	“ A Walk on the Yorkshire Coast, No. 2,” by Rev. W. C. HEY, M.A.	
„	20th.	On “ Art,” by Mr. A. W. TURNER, York School of Art.	
Nov.	13th.	On “ Iceland,” by Dr. TEMPEST ANDERSON.	

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Four Lectures on Greek Art by Prof. OWEN SEAMAN, Durham College of Science, Newcastle-on-Tyne.

Nov.	18th.	Lecture I.	“ The Artistic Sense of the Ancient Greeks.”
„	25th.	„ II.	“ Plastic Art of the Greeks from the Archaic Period to the age of Pheidias.”
Dec.	2nd.	„ III.	“ Pheidias and his School.”
„	9th.	„ IV.	“ From Pheidias to the Roman Period.”

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Dec.	11th.	“ A Conversazione.”	
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## NEW MEMBERS ELECTED.

Atkinson, John Thomas, 4, *West Bank Terrace*.  
 Badger, Henry Walter, 5, *Grosvenor Terrace*.  
 Bailey, George, *Marygate*.  
 Burnett, Mrs., 39, *Bootham*.  
 Cobb, William Henry, *Clifton*.  
 Croft, George, 6, *Avenue Terrace, Clifton*.  
 Ditmas, Major H. P., *Grosvenor Terrace*.  
 Garbutt, George, *Friar's Terrace*.  
 Gits, Leon, 8, *Bootham Crescent*.  
 King, Thomas Edward, 10, *Museum Street*.  
 Nelson, G.D., M.D., 15, *Bootham Terrace*.  
 Perkins, Richard, *St. Paul's Square*.  
 Rawling, Francis, *Swinegate*.  
 Robinson, Mrs., 49, *Holgate Terrace*.  
 Swaine, Miss Caroline Emilie, 23, *St. Mary's*.  
 Thomson, H. B., 8, *Davygate*.  
 Turner, Charles, *Clifton*.  
 Wade, Mrs., *Monkgate*.  
 Wales, Benjamin S., 18, *Grosvenor Terrace*.  
 Wilcox, Mrs. A., 15, *Avenue Terrace*.

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 Lean, Miss Henrietta L., *Mount School*.  
 Leonard, Mrs., 25, *Claremont Terrace*.  
 Luden, Mrs., 4, *Bootham Terrace*.  
 Waite, Miss Clara, *The Mount School*.  
 Walker, Mrs. R. G., 8, *St. Mary's*.

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Hutchinson, Roger, *The County Hospital*.  
 Pattin, W. H.C., *The Dispensary, New Street*.

## TEMPORARY SUBSCRIBERS.

Brougham, Major J., *Yorkshire Club*.  
 Purchas, Captain C., 2, *Wenlock Terrace*.  
 Wilde, Rev., *Portland Street*.

FOR THE YEAR ENDING 31<sup>ST</sup> DECEMBER, 1890.

EDWIN GRAY, Hon. Treasurer.

York, 3rd February, 1891.

J. A. CUNNINGHAME.

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The Proceedings of the Russian Geological Society, vol. ix., No. 1 and Supplement, vol. x., No. 2, vol. xi., No. 1.....	
Bulletins, vol. viii., Nos. 6, 7, 8, 9, 10, vol. ix., Nos. 1, 2, 3, 4, 5, 6. ....	The Society.
Memoirs Du Comité Géologique, vol. ii., Nos. 3 and 5, and ten small Pamphlets, by Prof. Pavlow .....	
Catalogue of Birds, vols. xiii., xv., & xviii. ,, Reptilia and Amphibia, parts 3 and 4 .....	The Trustees of the British Museum.
Guide to the Mineral Gallery and Guide to the Exhibition Galleries (Geological department) in the British Museum, parts 1 and 2.....	
The Eruption of Krakatoa and subsequent Phenomena .....	Miss Kirby, Grosvenor Terrace.
The Transactions of the New York Academy of Sciences, vols. viii, Nos. 5, 6, 7, 8, vol. ix., Nos. 1 and 2.....	
The Bulletin of the American Geograph- ical Society, vol. xxi., No. 4 and Supplement, vol. xxii., No. 1, 2, 3 ..	The Society.



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The Report of the British Association for the advancement of Science, Newcastle-upon-Tyne, 1889 .....	The Association.
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The 7th and 8th Annual Reports of the United States Geological Survey, 1885-6 and 1886-7, parts 1, 2 .....	United States Geological Survey.
The Report of the Smithsonian Institution, 1886, part 2, 1887, parts 1 and 2 ....	The Institution.
The Annual Report of the Bureau of Ethnology, 2 vols., 1883-4, 1884-5 ..	
Bibliography of the Iroquoian and Muskhogeian Languages, by J. Con- stantine Pilling. The circular, square, and octagonal earthworks of Ohio, and the problem of the Ohio Mounds, by Cyrus Thomas. Textile Fabrics of ancient Peru, by Wm. H. Holmes ..	
The Transactions of the Royal Society of Edinburgh, vol. xxiii., part 3, vol. xxxv., parts 1, 2, 3, 4 .....	The Society.
Proceedings, vols. xv. and xvi. ....	The Author.
Handbook of European Birds by J. Backhouse, Junr. ....	
The Proceedings of the Geologists' Association, vol. xi., Nos. 7, 8 .....	The Association.
The Memoirs and Proceedings of the Manchester Literary and Philosophical Society, vol. iii., 4th series .....	The Society.
The Transactions of the Natural History Society of Northumberland & Durham, vol. x., part 2 .....	The Society.
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Phycologia Britannica or a History of British Sea-weeds, vols. 1, 2, 3, 4, and a Manual of the British Marine Algæ, by W. H. Harvey, M.D. .... A popular History of British Sea-weeds, by the Rev. D. Landsborough, A.L.S., 1849 .....	A. W. Legard, Huntington, York.
The Transactions of the Zoological Society of London, vol. xii., part 10 .....	
A Monograph of the British Jurassic Gasteropoda, by W. H. Hudleston, M A., F.R.S., part 1, No. 4 .....	The Author.
The Transactions and Annual Report of the Manchester Microscopical Society for 1889 .....	
Bergens Museums Aarsberetning for 1889 .....	The Director, Bergen Museum.
The Norwegian North Atlantic Ex- pedition, Zoology, vol. xix.....	
Mittheilungen des Vereins für Erdkunde zu Leipzig, 1889 .....	The Society.
Annuaire Statistique de la Province de Buénos-Ayres, 1888 .....	
Meteorological observations at the Foreign and Colonial Stations of the Royal Engineers and the Army Medical department, 1852—1886 .....	The Director General.
Report of the Meteorological Council to the Royal Society for the year 1889, and Quarterly and Weekly Weather Reports .....	
Meteorological Observations at Stations of the second order for the year 1886	The Meteorological Society of London.
The Variability of the Temperature of the British Isles, 1869 to 1883, by Robert H. Scott, F.R.S. ....	
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Publication der Norwegischen Commis- sion der Europäischen gradmessung, Nos. 6, 7 .....	

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Nova acta der Ksl. Leop. Carol. Deut- schen Akademie der Naturforscher, Refractionerscheinungen (Stamberger See), Von Ferdinand Lingg. Bd. LV No. 1, Mit. 3, Tafeln i-iii. . . . .	The Academy.
The Transactions of the Leicester Literary and Philosophical Society, vol. ii., pt. 3, 1890, and 12 Report of Town Museum Committee . . . . .	The Society.
The Proceedings of the Bristol Natur- alists' Society, New Series, vol. vi., pt. 2	The Society.
The Journal of the Liverpool Geological Association, vol. ix. . . . .	The Association.
Papers and Proceedings of the Hampshire Field Club, No. iv. . . . .	The Club.
The Calendar of the Yorkshire College, Leeds, for 1890-91 . . . . .	The College.
A Descriptive Account and Guide of the Roman Villa recently discovered near Reading, Isle of Wight, by Nicholson & Price . . . . .	J. F. Walker, M A.
Explication de la Carte Géologique de la France, 1848, by Prof. Beaumont . . . .	
14 Vols. of Philosophical Transactions, 1792-1805 . . . . .	
Abstract of a Paper read before the British Association at Leeds, 1890, on Liassic Sections near Bridport, Dorset, by J. F. Walker, M.A. . . . .	
The Bulletin of the Mexican Meteoro- logical Society, vol. ii., Nos. 1 to 12 . .	The Society.
La Ville des Baux et ses seigneurs, par M. le Dr. L. Barthelemy . . . . .	Mr. W. J. Belt.
Notes on Roman Antiquities at Lincoln, by C. Roach Smith . . . . .	The Author.
The Annual Report of the Leeds Literary and Philosophical Society, 1889-90 . .	The Society.
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A list of Plants collected in the neighbourhood of Sheffield by Jonathan Salt.....	E. Haworth, Sheffield Museum.
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Atte della Reale Accademia dei Lincei, vol. v. Nos. 7-13, vol. v. Nos. 6, 7, 8, 9, vol. vi. Nos. 1-12.	The Academy.
The Annual Reports of the Brighton and Sussex Natural History and Philosophical Society, 1888-89-90 .....	The Society.
Bollettino delle Pubblicazioni Italiane, Nos. 97 to 106 .....	The Council.
The Healing Art and the Claims of Vivisection, the British Vivisector's Directory .....	The Rev. T. O. Morris, Nunburnholme.
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Three publications on the Conchology of the Mediterranean by Dr. Antonio de Gregorio.....	The Author.
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The 33rd Annual Report of the Borough of Sheffield Museum .....	The Committee.
The Presidential Address to the Society of Antiquaries of London, by John Evans, D.C.L. ....	The Author.
Report of the Trustees of the Australian Museum for 1889 .....	The Trustees.
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A specimen of the Horned Lizard, <i>Phrynosoma</i> . . . . .	
A specimen of the American Ostrich, <i>Rhea Americana</i> (Vieill) . . . . .	
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A small Series of Foreign Beetles and Moths . . . . .	Prof. Foster, Havard.
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DONORS.

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Another Roman Ring, also of Gold, delicately wreathed. It is set with a white stone on which is cut the rural Deity, Pan (?), holding two ears of corn, found near Barker Hill about 1876 . . . . .	Mr. & Mrs. R. Smith, The Valley, Scarbro'.
Three small Tablets, one of Marble and two of Stone, taken from a Columbarium or Catacomb at Rome, and formerly in the Campana Collection. They bear inscriptions beautifully cut . . . . .	
A piece of Stained Glass, probably of 17th century work, representing a St. George's Cross with an ornamented border, the artist was, perhaps, Henry Giles of York . . . . .	
Shield of Arms in Stained Glass with the bearings of the family of Percy, Quarterly . . . . .	The Very Rev. the Dean of York.
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	} Dr. Tempest Anderson.
	} Capt. Barstow.

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	} Capt. Thomson,
	} Bishopthorpe.

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A Sun Dial upon Pedestal ....	Mr. I. M. Williams.
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1890—Woodward (Arthur Smith), F.G.S., and Sherborn (C. D.), F.G.S., a catalogue of British Fossil Vertebrata, 8vo.	
1890—Claus (Dr. C.), Text Book of Zoology, 2 vols, 8vo., translated by Adam Sedgwick and F. G. Heathcote..	

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- 1889—Lobley (J. Logan), F.G.S., Hampstead Hill, its Structure, Materials, and Sculpturing, with list of Fossils.....
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- 1809—Martin (Wm.), F.L.S., Petrificata Derbiensia, 4to, Plates .....
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- 1845—Catalogue of the Fossil Organic Remains in the Museum of the Royal College of Surgeons: Mammalia and Aves, 4to., Plates.....
- 1817—Smith (Wm.), Stratigraphical System of Organized Fossils, 4to.....
- 1829—Knox (Robert), Human Osteology, 32 Plates, 4to. ....
- 1829—Mantell (Gideon), F.R.S., Illustrations of the Geology of Sussex, 4to., 19 Plates .....
- 1825—Artis (Edmund Tyrell), F.S.A., Antediluvian Phytology, 24 Plates, 4to.
- 1828—Martin (P. J.), A Geological Memoir of a part of Western Sussex, 4to.....
- 1878—Ramsay (A. C.), F.R.S., F.G.S., The Physical Geology and Geography of Great Britain, 5th Edition, 8vo. ...
- 1860—Mauray (Capt.), L.L.D., The Physical Geography of the Sea and its Meteorology, 8th Edition, 8vo.....
- 1885—Phillips (Prof. John), Manual of Physical Geology and Palæontology, part 1, Edited by H. G. Seely, F.R.S...
- 1890—The Geological Magazine .....
- 1827—Mantell (Gideon), Fossils of Tilgate Forest .....
- 1766—Brander (G.), Fossilia Hantoniensia, 4to, Plates.....

Wm. Reed, Esq., F.G.S.

## SERIAL WORKS SUBSCRIBED FOR.

Natural History of the Tineina, by H. T. Stanton, F.R.S.

Nautical Almanack.

Proceedings of the Zoological Society.

Publications of the Palæontographical Society.

„ „ Ray Society.

Sowerby's Thesaurus Conchyliorum.

Annals and Magazine of Natural History.

Geological Magazine.

Journal of the British Archæological Association.

Numismatic Chronicle.

Memoirs de la Société Paléontologique Suisse.

D'Orbigny's Paléontologie Française.

Geological Record.

Nature.

Publications of the Surtees Society.

Hardwicke's "Science Gossip."

The Yorkshire Archæological Journal.





## RESOLUTIONS

PASSED AT THE ANNUAL MEETING, HELD FEB. 3RD, 1891.

1. That the Report of the Council now read be adopted and printed for circulation amongst the Members, Lady Subscribers, and Associates of the Society.

2 That the thanks of the Society be given to the Members of the Council retiring from office, also to the Treasurer, Secretary, and Curators, for their valuable services; and that authority be given to the Council to give admission to the Public to the Museum on Whit-Monday and Tuesday, under the same regulations as last year.

3. That the thanks of the Meeting be given to the Chairman.

A CATALOGUE  
OF THE PLIOCENE ECHINOIDEA  
*IN THE REED COLLECTION,*  
IN THE  
MUSEUM OF THE YORKSHIRE PHILOSOPHICAL  
SOCIETY.

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With the exception of the Lower Cainozoic deposits of the London and Hampshire Basins, no English deposits were more diligently explored early in the century than the Craggs of Suffolk and Essex. The Eocene and Oligocene deposits at first offered greater attractions to geologists owing to the superior beauty and the tropical affinities of their fossils. Hence in such early catalogues as that in Conybeare and Phillips' "Outlines of the Geology of England and Wales" (1822), the Crag lists were very brief in comparison with those of the older deposits. But as the introduction of railways rendered the Eastern coast more accessible, and as the value of the phosphate nodules became better appreciated, the attention of geologists was diverted to the rich Crag fauna and during the next thirty years the greatest collections from the beds were made. Hence when in 1852, Professor E. Forbes published his "Monograph of the British Tertiary Echinodermata," he had access to most of the best of the material now preserved in our principal Museums. Since then, other workers have been busy in the deposits and the Wallace and Canham Collections at Ipswich, the Montague Smith Collection at Cambridge, and others have added considerably to our knowledge of the Crag fauna. But of these later collections, that made by William Reed, Esq., M.R.C.S., and presented by him to the Museum of the Yorkshire Philosophical Society, is probably the most valuable and it contains most of the choicest finds made in the Craggs during the past five and twenty years.

Owing to the kindness of Mr. Reed, the Echinoidea of this Collection have been allowed to visit London, and thus I have been enabled to make a more detailed study of them than would have been possible in a short stay in York. For this privilege I must express my best thanks to Mr. Reed. The collection, beside adding considerably to our knowledge of distribution, has added one species new to England, the female form of *E. henslowi*, and two new species.

As the Reed Collection adds in many ways to the record of the distribution of the Crag Echinoids and as it includes several specimens to which M.S. names have been attached, it may be as well to accompany a description of the new species by a full catalogue of the collection.

As the synonymy is treated in detail in a "Revision of the English Cainozoic Echinoidea" recently read before the Geologists' Association, it is not repeated here.

Family *TEMNOPLEURIDÆ*.

Sub-Family *GLYPHOCYPHINÆ*.

Genus *Temnechinus*. Forbes 1852.

This Genus is one of the most interesting and puzzling in the Crag fauna. Professor Forbes recognised four species while Professor Duncan and Mr. Sladen have since added others from the Indian Cainozoics, and Professor A. Agassiz a recent form. The five deep depressions in the summits of the interradii and the greater flatness that accompanies them in most of the Crag specimens are not easily to be explained. Professor Forbes regarded this as a definite specific character and separated as *T. melocactus*, those of the common species without these structures. For reasons that will be more fully discussed in the Proceedings of the Geologists' Association, I have been led to regard this as a case of sexual dimorphism and consequently propose to merge the two species. The *Temnechini* in the Reed Collection may therefore be catalogued as follows :—

*Temnechinus woodi* (L. Agassiz, 1846).

Coralline Crag. Ramsholt. Sutton.

Red Crag. Boynton; Foxhall; Sutton; Waldringfield; Woodbridge.



From reasons discussed in the paper read before the Geologists' Association, it is recommended that three of the species of *Temnechinus* founded by Professor Forbes should be merged; this receives the earlier name of L. Agassiz.

Family *ECHINIDÆ*.

Genus *Echinus*. Linn, 1758.

*Echinus woodwardi* (Desor), 1846.

Coralline Crag. Iken; Orford; Gedgrave; Aldboro.

Red Crag. Walton on Naze.

*Echinus esculentus*, Linn, 1758.

Coralline Crag. Gedgrave.

Chillesford. Sudbourn.

*Echinus miliaris*, P. L. S. Müller, 1771.

Red Crag. Foxhall; Suffolk.

*Echinus charlesworthi*, Forbes, 1852.

Coralline Crag. Sutton.

*Echinus paucimiliaris*, n. sp. Pl. I., fig. 1.

Diagnosis :—An *Echinus* of medium size, circular, depressed, but with a tendency towards a conical shape.

*Apical system* fairly large.

*Ambulacra* :—The pores are in very oblique arcs, so that the poriferous zones are wide. There is a row of large tubercles down each side of the area and a few scattered granules between. An alternation of wide plates bearing large tubercles with narrow plates ornamented only by granules occurs.

*Interadii* :—A large tubercle occurs on each side of each area throughout the whole series. Except at the very summit, each plate has a second tubercle almost equal in size, so that the area appears packed by four rows of large tubercles. There are but few granules.

Dimensions :—Height - - - (about) 15 m.m.

Diameter - - - - - 28 m.m.

Diameter of apical system - - 7 m.m.

Width of ambulacra at ambitus - 7 m.m.

Width of interradii at ambitus - 12 m.m.

Distribution :—Red Crag, Butley. Type :—Reed Collection, Yorkshire Museum.

Remarks :—By its size and general proportions this species resembles *E. miliaris*, O.F.M., from which it differs in the tuberculation. In *E. miliaris* a row of large tubercles runs down each side of the interradii and each ambital plate has in addition four or five secondary tubercles and a crowd of granules. In the new species corresponding plates have two tubercles nearly equal in size, with occasionally one or two small secondary tubercles and a very few granules. The tuberculation of the Crag specimens of *E. miliaris* agrees fully with that of recent forms: the vertical row of secondary tubercles does not become pronounced till the sixth plate from the summit instead of on the third, as in this new species.

*Echinus woodi*. Desor, 1856. Pl. I., fig. 8.

There is a fragment apparently belonging to this species in the collection from the Coralline Crag of Orford. The only other specimen of this species was identified by Professor Forbes in his monograph as belonging to the characteristically Mediterranean *Echinus melo*.

*Echinus henslowi*. Forbes, 1852. Pl. I., fig. 2, 3 & 4.

Red Crag. Walton.

In this paper, an *Echinus*, from the Red Crag at Walton, which was named *E. ruber* by Mr. Keeping, is referred to *E. henslowi*. This course has only been done after considerable hesitation. The tuberculation differs from that shewn by Forbes, in his enlarged diagram showing the arrangement in a plate of *E. henslowi*; but a careful examination of the type shows that this figure is not quite accurate in details, and that the distribution of the granules is practically identical in the two specimens. The main difference between the two specimens is in their general form: *E. henslowi* is conical, and the Reed Collection specimen very depressed; the area round the apical system has been destroyed in the latter, but the British Museum has recently received a specimen which explains the depression. In this specimen there is a series of five hollows in the summits of the five interradii, and these are connected by a depressed ring which surrounds the apical area. The cause of these depressions is at present quite uncertain; exactly the same arrangement is found in the depressed forms of *Temnechinus*

*woodi*, Fbs., whereas the normally subconical individuals of that species do not possess these structures; the latter were therefore separated by Professor Forbes as *Temnechinus melocactus*. M. de Loriol has figured a specimen of *Tripneustes variegatus*, from Mauritius, which has a very similar series of cavities, and it is interesting to note that it is here also accompanied by a marked depression in form. I am indebted to Prof. F. Jeffrey Bell for showing me a series of specimens of the same species from Mauritius, in which the same structures occur, though they are often very irregular. The majority of the specimens of the recent species are normal, whereas in *Temnechinus* it is the reverse. Until a dissection of one of the Mauritius specimens has been made, it is very hazardous to express any opinion upon the matter, but the striking regularity of these depressions, especially in *Temnechinus woodi* suggests that they are not mere malformations. It may be that they are marsupial pouches as suggested also for *T. woodi*, analogous to the deeply impressed ambulacra in some Spatangoides, as *Hemiaster cavernosus* (Phil.); and if so, the conical forms without these cavities may be the males.

*Echinus sphaeroideus*. (Cotteau) 1880. Pl. I., fig. 5 & 6.

Coralline Crag. Boyton.

There is a beautiful little specimen of this species in the collection; it agrees fully with M. Cotteau's admirable figures and descriptions. It has not been previously recorded as occurring in England.

#### Family *ECHINOMETRIDÆ*.

Genus *Strongylocentrotus*. Brandt, 1834.

*Strongylocentrotus scaber*, n. sp. Pl. I., fig. 7.

*Form*:—Low and depressed abactinally: well rounded at ambitus.

*Apical system*, large.

*Ambulacra*:—The pores are in arcs of six pairs: near the summit they form a nearly vertical series, but at the ambitus they are in oblique curves. There are eight or nine plates between the summit and the ambitus. The tubercles are large though smaller than in the interradii.



*Interradii* :—Of high plates, six or seven, between the ambitus and the summit. A row of large tubercles runs down each side of each interradius. A series of small secondary tubercles occurs along the middle of each area, and this becomes zigzag at the ambitus. In the same region, and on the actinal side, there is also a row of secondary tubercles on the adambulacral sides of the plates. A few small miliaries are scattered over the area.

Distribution :—Coralline Crag, Aldboro'. Type :—Reed Collection.

*Remarks* :—This species is totally unlike any Crag Echinoid, and the roughness of the test (whence the name) produced by the large size of the tubercles, would enable scattered plates to be recognized. The genus has not been previously recorded, at least in Europe or America, from deposits older than the Pleistocene. Among recent species it most resembles *S. eurythrogrammus*, with which it agrees in the arrangement of the tubercles and pores; but the new species differs from this in the much larger size of both its tubercles and apical system.

#### Family *FIBULARIIDÆ*.

Genus *Echinocyamus*, Van Phelsum, 1774.

*Echinocyamus pusillus* (O. F. Müller), 1776.

Coralline Crag. Sutton.

Red Crag. Allerton; Hollesley; Sutton; and Walton.

#### Family *SPATANGIDÆ*.

Genus *Spatangus* (O. F. Müller), 1776.

*Spatangus purpureus* (O. F. Müller), 1776.

Red Crag. Sutton; Woodbridge.

Genus *Brissus*. Gray, 1825.

*Brissus unicolor* (Leske), 1778.

Coralline Crag. Iken; Orford.

Genus *Echinocardium*. Gray, 1825.

*Echinocardium cordatum*. (Pennant), 1777.

Coralline Crag. Boynton (Spines).

Red Crag. Sutton (? Cor. Crag); Walton.

J. WALTER GREGORY.

## THE WIND-RUSH AT YORK,

MARCH 8TH, 1890.

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On this date there was a severe thunderstorm, which, soon after two o'clock, stretched, in a line 50 miles long, from the N.W. of York to near Huddersfield, and moved slowly in a S.S.E. direction, so that it was over Leicestershire at five p.m. Heavy falls of soft hail occurred at York, Tadcaster, and elsewhere. The Rev. W. Clement Ley, of Ashby Parva, near Lutterworth, Leicestershire, noted considerable resemblance to the celebrated "Eurydice" Squall, of March 24th, 1878, especially in a strange backing of the cirrus clouds, towards the S.W., just before the storm burst over him.

About 2-45, whilst the storm was still raging, a so-called "whirlwind" swept along a four mile track, just south of York, doing damage to one or two hundred objects. Details of it\* were read before, and are now published by, the Royal Meteorological Society, to whom we are indebted for the use of the accompanying plate, reduced from the six-inch ordnance map,† and for figures 1 to 5.

The map shows that the violent wind began S.S.W. from York, at a distance of three miles, and ended three miles E.S.E. of the Minster Chapter-House; its path was pretty straight, from W.S.W. to E.N.E., and measures over four miles in a straight line.

The number (1) on the map lies on a small plantation to which no certain damage was done; at (2) is a dismantled, roofless barn. The west gable was blown down, the bricks lying flat and little separated. Yet an oak over it had hardly a twig damaged. For some time, as the numbers show, the line of mischief was very narrow. No tree was much damaged

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\* Several boys from Bootham School kindly collected observations E. of the Ouse, nearly all of which I was able later to verify, observing, further, W. of the Ouse and Nos. 123—133. The chief observers were:—Egbert C. Morland (twice) and C. H. Merz (Nos. 38 to 75); F. G. Fryer and A. Beale (79 to 110) and F. G. Fryer again (119—129). J. P. J. Malcolmson and L. Baker also took some photographs.

† The map, and photographs of aneroidograms, will be found at the end of the Report.

before (10), 400 yards further on. From this ash, the usual hedge-tree of the district, four branches were torn, the largest being 39 ft. long and  $1\frac{3}{4}$  ft. in diameter. At the road beyond, two ashes, 40 yards apart, (14) were untouched, a few boughs being torn from an oak in the opposite hedge, between them. The first tree uprooted was in the next hedge, (16), a fine, sound ash,  $2\frac{1}{2}$  ft. across.

An unsound ash (22), a little further on, was snapped across, though 3 ft. thick. Next the gardener's greenhouse and cottage, attached to the Archbishop's grounds, were reached. The former lost a chimney, the latter a few tiles. The gardener was just outside behind his house ; so deafening was the roar that he did not hear the crash of falling trees in the grounds across the road, among them two splendid elms (26), both uprooted, though a plane tree, touching the southern one, was untouched. He had noticed that the wind was rising some five minutes before, and there had already been some strong gusts.

Passing next along the river reach, no damage was done on the south bank, until a row of large elms (38, 39, 40) was reached and three or four were uprooted, including one 4 ft. in diameter and 80 ft. high. Some rooks were killed among the branches, not having time to fly out and escape. Captain Key, of Rose Hall, and his foreman were sheltering in a hut not 100 yards away, but the terrific roar entirely drowned the crash of falling trees.

As the other bank of the Ouse was also affected, the width from here to the river-bend must have been at least 250 yards. Here it passed over Rose Hall, removing its south-east chimney and a few tiles. This and its group of farm-buildings and cottages were the only houses, besides the cottage already mentioned, along the whole four miles. The villages of Bishopthorpe, Fulford and Heslington all lie within 200 or 300 yards. Behind Rose Hall much havoc was done in the farm-yard ; more tiles were displaced and many stacks (49) were upset and scattered, whilst others among these escaped quite scatheless. A large and new Dutch barn (51) was upset over a hedge, its legs being left elevated in the air. A barge (47) had stout moorings snapped "as if they were cords" and



its boat swamped. Indeed the storm seems to have been here at its worst. In the dip beyond, two ashes (58) and a splendid oak (55) were uprooted. Many trees, especially willows, had the bark stripped off branches and twigs. Just beyond, a barn (60) was half untiled and blown askew, three ashes shattered and a stack demolished, its hay lying thick for a width of 50 yards on the next two hedges. The track here followed a drainage stream, to "West Moor," the long approach to Tilmire Common. On this section of  $\frac{3}{4}$  mile it was narrow again and damage was confined to the tearing off of limbs and boughs. Then there was a sudden access of fury, on the southern edge, as shown by uprooted trees, &c. (86—91), for a width of 500 yards, and this continued to the Heslington "out-gang" to Tilmire. No. (110), in the village, represents an apple tree, wrenched off at the head of the trunk. It is the only serious damage N. of the main track, whereas several numbers show more or less damage S. of it. At (109) a small barn was blown down. Then comes the treeless  $\frac{1}{3}$  mile of Heslington "Low Field," with slight damage along the southern boundary lane. The damage in the "Ox Closes" was confined to branches, except that, at the very last, a large, but unsound ash-tree (133), was snapped across. Beyond this, the wind for some distance was very violent, but I neither found nor heard of any further damage.

Violent gusts of wind occurred later in the afternoon from time to time, but no other damage was done near York. Branches were, however, torn off near the place where the N. E. R. crosses the Wharfe at Bolton Percy. An hour and a half later there was violent wind in Notts. and Lincolnshire, with damage in the latter county, especially the destruction of a windmill at Heckington, 70 miles S.E. from York.

Captain Key appears to have had the best view of the gathering storm. "It appeared to me," he wrote, "as if two angry thunderclouds met over the Archbishop's Palace at Bishopthorpe [S.W. by W. from his position], one coming from the South, the other from the North-west." Then "there was a sort of roar, the hut trembled, and all was over in less than a minute." Lightning flashes were noticed both before

and behind in the line of the storm, and it darkened perceptibly. The Archbishop's gardener also said that it lasted about half-a-minute. "It was over before we had time to be frightened, or to run out to see what it was," said the good woman of a cottage near Rose Hall.

It was about this time that two Bootham School boys (J. A. Collinson and Noel Cumine), were returning up the bit of hill (VII. on the chart), from Knavesmire race-course to the Mount, when a vivid flash was accompanied by simultaneous thunder. It "struck a pool of water about four feet in front of us and sent the water aside to right and left." I should judge that the main flash was more distant, the splash being due to one of its ramifications along the drenched highway.

The Roman numerals II. to VI. show the position of rain-gauges, which recorded from 0·15 to 0·18 inches of "rain," including slight falls later in the afternoon. At my own house (I.) I noticed that the hail was only thick enough just to whiten the ground, a light wind at the time blowing West-by-North.

When we turn to the meteorological conditions prevalent at the time, it so happens that the records are unusually complete, especially as regards the barometer. For not only have we the permanent records of several recording aneroids, but York, thanks to the splendid series of records kept for our Society by Prof. Phillips and John Ford, was, in 1872, made one of the main stations of the Meteorological Office, and the storm came quickly after the 2 p.m. observations had been taken throughout the country.

The 8 a.m. chart, copies of which are sent out daily to subscribers, showed three depressions; 28·8 ins. N.W. of Scandinavia, 28·8 ins. over Finland, and an approaching and increasing depression of 29·2, or lower, N.W. of Ireland. There were also two secondary depressions over the North Sea, and, apparently, a third over, or S. of, St. George's Channel. High pressure, 30·0 ins., lay over the Pyrenees. Hence the forecast, "squalls, some rain," was natural.

Fig. 1 shows the conditions at 2 p.m. In general the gradients, that is the difference of pressures between two given







the time), we see that a rapid fall during the morning was checked soon after 2 p.m., a slight rise setting in, followed by a sudden jerk upwards, of 0.02 in., about 2-45. Then the fall

Fig. 2.

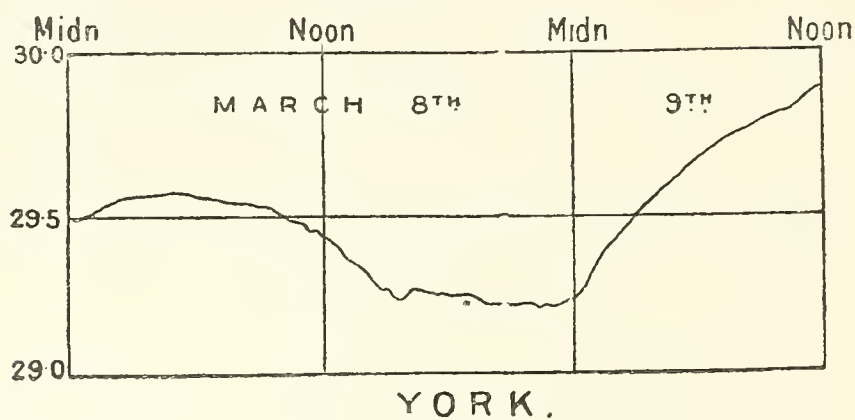
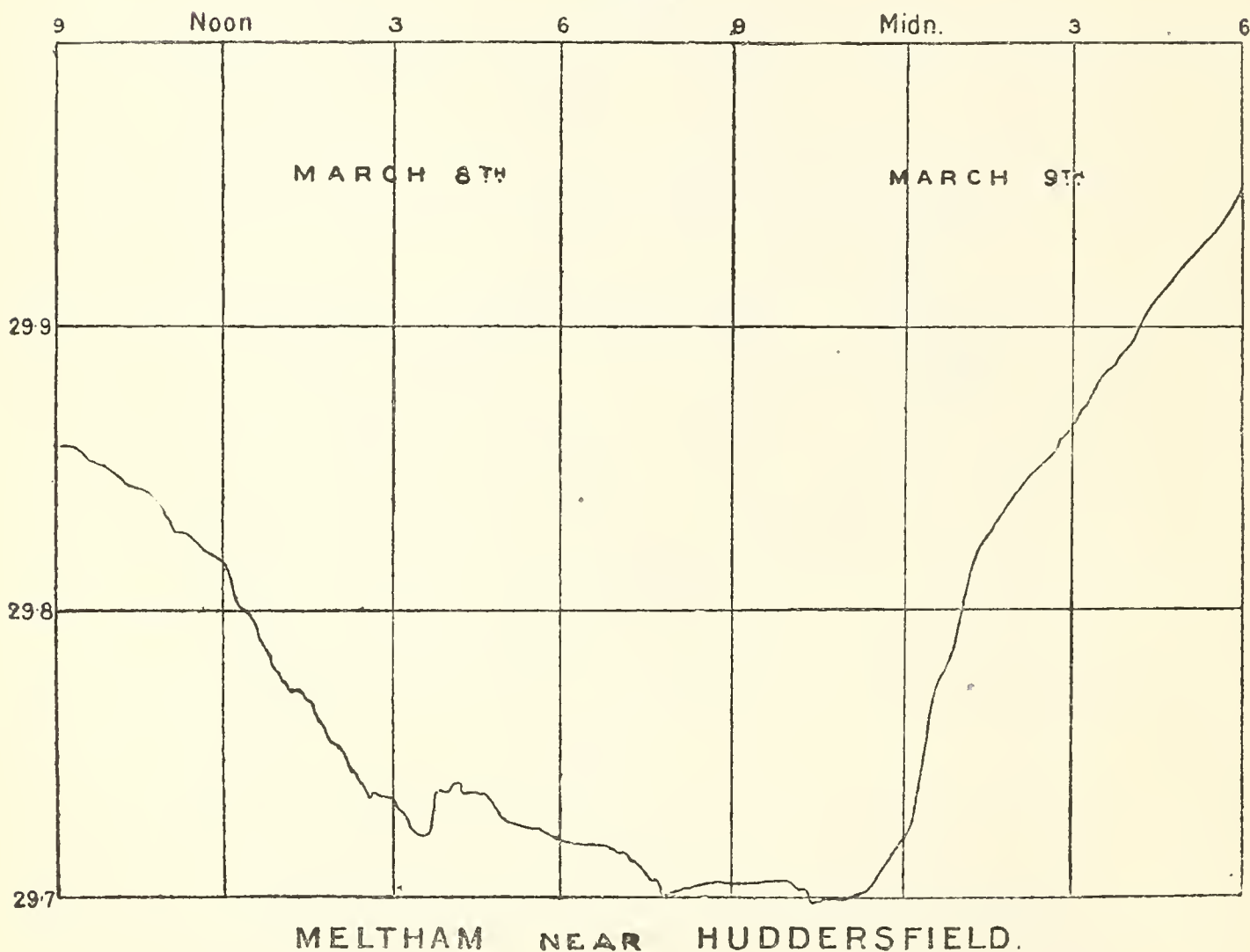


Fig. 3.

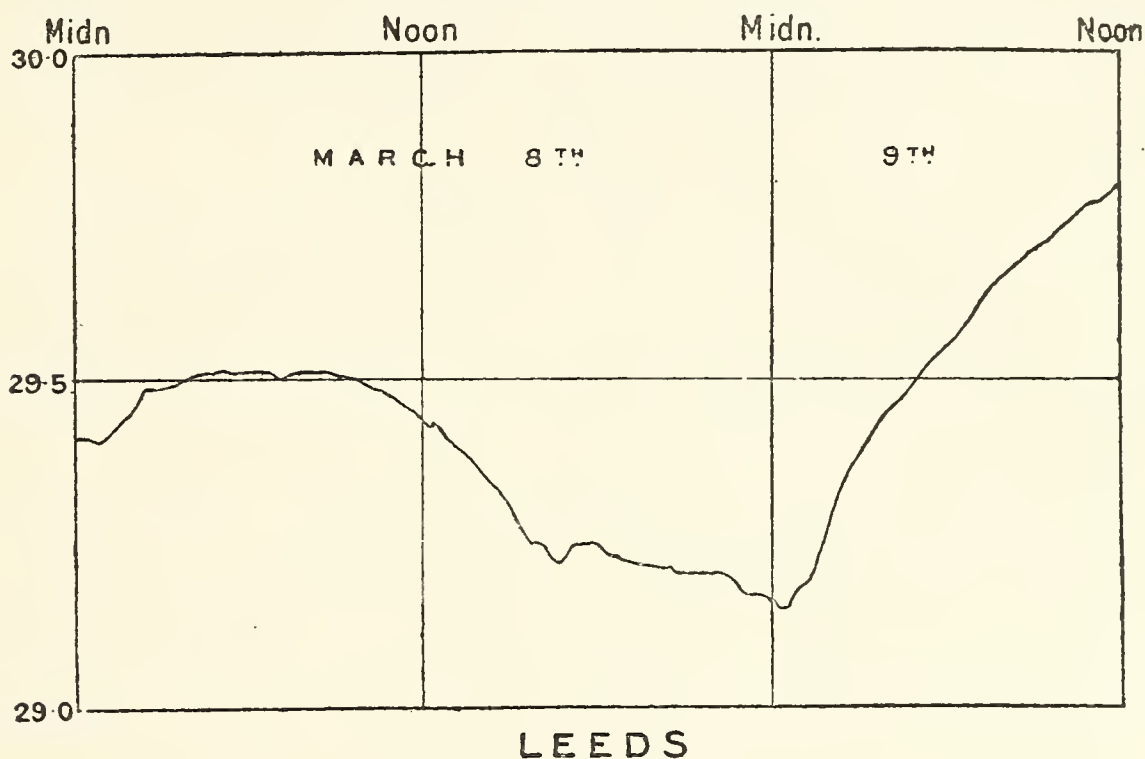


continued until 3-30, when there was a yet more marked recovery, followed by a further slight fall until 10 p.m. At midnight there began a rapid and steady rise of nearly an inch in 22 hours.

The most notable incident, however, was overlooked by the engraver, and indeed had escaped my own attention until three

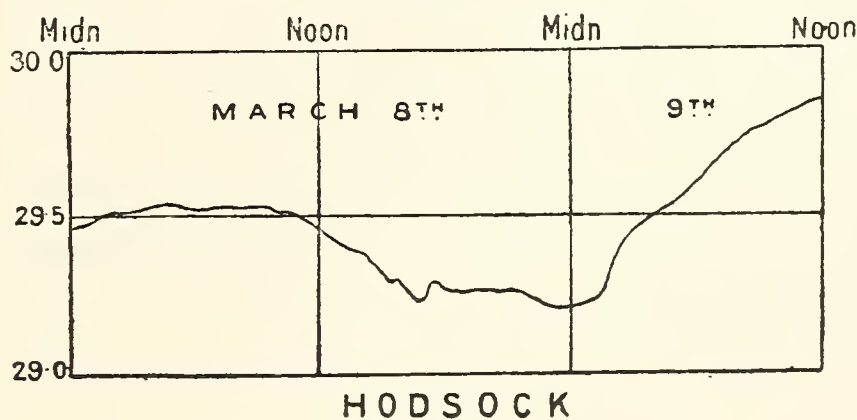
barograms, traced in 1890 near American tornadoes, came to my hands. Two of these were made during the great Louisville Tornado, on March 27th. The three are now reproduced photographically from the enlarged cuts in *Science*, kindly photographed by J. P. J. Malcomson, of Bootham School.

Fig. 4.



With them is a micro-photograph, kindly made by Thomas H. Waller, B.A., B.Sc., of Birmingham, of the tracing at Bootham School, distant  $2\frac{1}{2}$  miles from the centre part of the wind-rush. The comparison, it will be seen, is with the Cincinnati curve,

Fig. 5.



not that at Owensborough. The former is a wedge-shaped *rise and fall*, the rise of about 0.16 inch, the fall of 0.1 inch in a straight line, changing by a steep curve of 0.04 inch into a gentle fall of 0.03 in  $1\frac{1}{2}$  hours. There had previously been a rapid fall of 0.15 inch in  $1\frac{3}{4}$  hours. The York micro-photograph

shows a similar rapid fall, previously, of 0·15 inches in two hours. The wedge-shaped rise is only 0·02 inch, followed by a fall as rapid as before for nearly an hour. Then comes the sudden rise which marks the passing by of the secondary depression, followed by a further gentle fall.

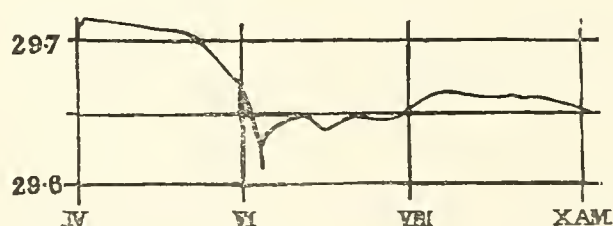
The St. Louis, Missouri, record, of a tornado in January, shows the same rapid fall, but the upward jerk, of 0·11 inch, is vertical, followed, without any previous rapid descent, by a gentle fall of 0·02 in two hours.

But, in the Owensborough tracing, there is a *fall and rise*, absolutely vertical, of rather over 0·1 inch, followed by a further upward curve of nearly 0·02 inch, before the succeeding gentle fall. Both these, also, show signs of a rise about  $1\frac{1}{2}$  hours later than the jerk, but the cuts cease at this point.

Since the above photographs were made I have received, through the kindness of T. W. Backhouse, F.R.A.S., of Sunderland, and E. B. Mounsey, Esq., of Darlington, a second aneroidogram, made during a 'whirlwind.' The instrument was at the latter's house, Ashburne, Seaton Carew, a suburb of Sunderland.

About 7-30 a.m. on August 15th last a 'whirlwind' passed along Church Street, 230 yards to the south. It was stated to have moved from W. to E. Three holes, each about two yards in diameter, were made in the roofs on the south side. The roofs were of black tiles, but as the repairs are in red, the places are conspicuous! It had blown down a tree before Church Street, and afterwards went out to sea, raising the water. Mr. Mounsey writes: "The Postmaster was in his little garden behind the shop, and two flowerpots, with plants in them, manifested a desire to fly over the wall, but did not succeed. Mr. Noddings, the joiner, saw the tiles flying upwards eight or

Fig. 6.



SEATON CAREW.



ten feet or so over the houses in Church Street, from his workshop, distant, say 80 or 100 yards. He ran at once out on the bank, from whence he saw the water whirled up, as the commotion passed eastward out to sea." At Ashburne "there was a gusty wind at the time, but nothing very noticeable."

Now the cut of this barogram, also one of Richard Frères (the time is not correct), shows a rapid descent of 0·05 in less than an hour, followed by a sharp practically vertical *fall* of 0·04 inch, and immediate vertical rise of nearly 0·03 inch. Then comes a curve closely resembling that at Owensborough.

We notice that this jerk *down* is but double the York jerk *up*, although at the latter the disturbance was twentyfold more distant. This may partly, but by no means entirely, be ascribed to the latter being more violent.

It would seem as if, in the immediate neighbourhood, there was a slight suction, changing, however, rapidly into an increase of pressure, which alone makes itself felt at greater distances.

Or possibly, we have to deal with two different phenomena. The American tracings might throw some light on the question, if we can find how far off their records were made. But it can only be settled decisively if a whirlwind kindly develops itself in close proximity to one barograph, with a second at no great distance.

We may perhaps refer here to one or two points of photographic interest in the York micro-photograph. The ruled lines and figures in the original were red, except that the "8th" upon the big 5, giving the date at noon, was in black ink. The aneroidogram itself is in a violet aniline ink. At first Mr. Waller failed to get any signs of it, with ordinary plates and a magnesium flash, whilst even ortho-chromatic plates gave but the ghost of a tracing. It then struck him that, possibly, the best results would be obtained with the more diffused and less intense light of an ordinary lamp, and he thus obtained the satisfactory negative from which our plate is taken.

The second line, at the top, is the tracing of the previous week. The thickening, after 4 o'clock on the 8th, is a very usual concomitant of gusty or stormy weather. Indeed, the barograph makes thus its own record.

The chief difference in the three other English tracings is the *absence of the upward jerk*, at the close of the slight rise coinciding with the thunderstorm. This rise with a sudden rain or hail storm is a familiar occurrence, though the cause is obscure. It is possibly due to the sudden contraction of the air in cooling, which causes an inrush from outside the storm area. The sudden jerk would seem to be connected with the "whirlwind" itself. But does it represent cause or effect? Mr. Brook thinks that his barogram at Meltham has a similar jerk, in addition to the slight rise shown about 2-15 p.m. in fig. 3.

Fig. 3, from Mr. C. L. Brook, of Meltham, near Huddersfield, 38 miles S.W. of York, is on a much larger scale and shows clearly the delicate variations of pressure. Fig 4, from Messrs. Reynolds and Branson, Leeds, is apparently an hour fast. Leeds is 23 miles S.W. by W. Fig. 5 is from Mr. H. Mellish, Hodsock Priory, near Worksop, 46 miles S. of York. Almost identical too, is the record kindly submitted to me, obtained by the Rev. W. C. Ley, at Ashby Parva, near Lutterworth, 95 miles S. of York. The rise accompanying the thunderstorm was here *very* slight however. It occurred at 5 p.m. If, as the facts mentioned previously seem to indicate, the storm advanced in a S.S.E. direction, it had traversed the 82 miles here from Huddersfield in  $2\frac{1}{2}$  hours, or with a speed of translation of about 33 miles an hour. The recovery after the secondary depression is at 5-40 and very sharp ; indeed a *jump* of 0.03 inch.

A glance at the 2 p.m. chart (fig. 1) shows that the thunderstorm, as is customary, was S E. of the main depression, and at York in the south-eastern "octant" of the secondary depression as well. It occurred at all five stations, from which our aneroidograms are sent, about an hour before this traversed the district.

By 6 p.m. the main depression was near Glasgow and had slightly filled up. Next morning it was at Christiana and pressure had rapidly recovered over England, where clear, cold weather prevailed, with moderate, north-westerly breezes.

There now only remains the comparison with American



tornadoes. Newspapers have made us so familiar with these that we need not dwell long on their nature. They develop, always, S.E. of a centre of low barometer, and generally, 200 miles or more distant, where volumes of moist, warm air are attracted northwards from the Gulf of Mexico. Their course is towards E.N.E., in tracks rarely over a few thousand feet wide and generally only a few miles in length, but almost everything is swept before them. Other tornadoes often follow at regular intervals of time and distance. That at Louisville, Kentucky, on March 28th, 1890, the most destructive since Grinnell, Iowa, was visited in 1882, was one of *eighteen* such, “besides violent storms of hail and straight winds.” 76 lives were lost, although 12 hours’ warning had been sent to the district. The roar was “like a thousand trains on bridges.”

The points of resemblance, however, are so many as practically to give a summary of the whole phenomenon. We have :—

- (1) The meeting of two clouds to the S.W. by W.
- (2) A sudden darkening.
- (3) The overpowering roar.
- (4) The association with a thunderstorm.
- (5) The thunder and lightning accompanying the “rush.”
- (6) The position in the S.E. octant of the depression.
- (7) The centre was 300 miles distant.\*
- (8) The “Tornado season” runs from March to September.
- (9) They begin “just after the hottest part of the day.”
- (10) The destruction at Heckington, 70 miles S.E. of York, of the windmill, about  $1\frac{1}{2}$  hours later.\*
- (11) The definite and narrow limits of width.
- (12) The direction, W.S.W. to E.N.E. (more S.W. to N.E. in tornadoes).
- (13) The chief damage along the S. border.
- (14) The rapidity of transit.
- (15) The absence of any *conclusive* proof of a true whirl at the earth’s surface.

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\* Compare these with Prof. Hazen’s summary (*Science*, XV., p. 270), where it says :—‘an hour or so later, another line    ♦    \*    \*    about 50 miles S.E. of the first,’ which itself develops ‘200 to 400 miles to the S.E. of the centre of the general storm.’



- (16) The absence of any barographic sign of a great and instantaneous decrease of pressure.
- (17) The presence of a temporary rise, accompanied by a sudden jerk, the final result, at least, being upwards, of 0·02 at York, of 0·17 at Cincinnati.
- (18) In all five cases the barometer at the time was near, or at, the end of a rapid fall. This is, of course, in close connexion with such storms occurring in the S.E. octant, if the depression is following the usual S.W. to N.E. course.

We may note that, not only is there no absolute proof as yet that tornadoes blow along the ground in whirls, but, also, none of the stories of corks leaving empty bottles, &c, from any sucking action, causing a partial vacuum, have as yet been confirmed. Again, houses are said to have burst outwards because of a sudden diminution of the external pressure. Such cases, however, are explained by the wind getting in on the exposed face and hence, naturally, bursting the others outwards. There is, plainly, some relation between the thunderstorm and the wind-rush, but our present knowledge does not appear to be sufficient to say what. The latter, it will be noticed, moved *across the face* of the former. In this way it differed from the sudden gusts, which sometimes accompany such storms. The thunderstorm itself is of the type to which squalls belong, as was pointed out earlier. These, again, differ from the great cyclonic storms, which often affect half or all our country at a time, when the wind blows inwards, spirally, towards the centre of depression.

The thunder-cloud, it must be noted, moved almost at right-angles to the wind-circulation of the main cyclonic-storm, just as the wind-rush was perpendicular to it. Hence the wind-rush was parallel to the direction of the general wind of the afternoon. It may possibly have been a portion of it intensified, in some way, by the passage either of the thunder-cloud or of the unknown cause by which thunder-clouds are produced.

J. EDMUND CLARK.

POST SCRIPT.—In response to enquiries the following information has been kindly sent by the United States Weather Office:—

“The tornado at St. Louis, Mo., on January 12th, 1890, passed within about 2,800 feet of the position of the barograph. That at Owensboro, Ky., on March 27th, 1890, passed about 7,000 feet from the barograph. By a typographical error, “Science” gave a tornado at Cincinnati, Ohio, on March 27th, 1890, which should have been a thunderstorm, though intimately connected with the Louisville, Ky., tornado. A copy of the original sheet at St. Louis, Mo., for January 12th, is sent with this. The original sheet at Owensboro, Ky., unfortunately for this country, was given by its owner to Prof. A. Buchan, of Edinburgh, Scotland, of whom it is probable you can get a tracing.—A. W. GREELEY, Chief Signal Officer, February 25th, 1891.”

The request here suggested was made, but nothing further has been received.

The explanation of the Cincinnati curve perhaps points to a connection between the upward “kick” and gusts of wind due to thunderstorms, when the latter are the predominating phenomena. Such “kicks” have been noted when no special wind-rush occurred. Possibly they are due to swirls not reaching down to the earth’s surface, of the kind which may be noticed causing such commotion among the thunder-clouds. The association here with the Louisville tornado lends support to the suggestion.

The Seaton Carew curve was due to a whirl without a thunderstorm, at St. Louis and Louisville this was subordinate. We may notice how, in all five tracings, the effect occurred during a rapid fall, soon followed by a rise.

As the St. Louis curve shows several interesting details, not given by the rough figure in “Science,” it is the more unfortunate that we have not at hand a more accurate tracing of the Owensboro record. “Science” represents the former by a steady descent of one-tenth inch in  $1\frac{1}{4}$  hours, suddenly changed to a vertical, *i.e.* instantaneous, rise of rather more; after which the curve bends sharp over, falls about one-fortieth inch in the next two hours and ends with symptoms of a rise.

In the exacter tracing, for the whole of the day, we find a tremulous line from midnight to mid-day, which indicates unsteady pressure. This, until 5 a.m., rises and then falls between 29.42 and 29.44. By noon it is down to 29.18. Then follows a rapid fall, with steady line, until 5-15 p.m. A jerk at 2-30 and again at 9-15, appears to be accidental. At 5-15 the tracing lies at 28.87; the next quarter hour saw it reach 28.82, this sudden drop being due, possibly, to the suggested suction. In the next five minutes there is a rise to 28.93 or 0.11 in., instantly followed by a drop of nearly 0.03 and a second recovery of 0.02 by 6 p.m.; then follows a second slight oscillation before 6-30 and a slight drop to 28.89 until 8. Here begins a rapid rise so that the record at 10 p.m. is 29.06, and at midnight 29.16 inches.—J. E. C.

## LIST OF FIGURED SPECIMENS IN YORK MUSEUM.

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The following is a list of all specimens in the Palæontological Collections of the Yorkshire Philosophical Society known to me as figured specimens. It should be noted that, owing to the munificence of Mr. W. Reed, F.G.S., the collections of the Society include—the Reed Collection, the Whincop and Baker Collections (Crag Fossils), the Wood Collection, and a large part of the Bean Collection.

This list contains a good many “type” specimens; but it does not seem to me that anything is gained by separating figured specimens that are types from those that are not.

In many cases the generic, and even the specific, name under which a specimen was figured has been subsequently changed. Where this is the case, I have put the original name in brackets.

Several specimens in this list have not been *marked* as figured specimens, but there is every reason to believe that they are the originals of the figures to which they are referred. In all such cases a mark is put to shew that the specimens cannot boast an unbroken tradition.

Many figured specimens belonging to the Society's collections have not been identified, and are therefore not mentioned below. Possibly in some cases the specimens have been lost. I hope at some future time to give as complete a list as I can make of figured specimens, other than those here given, which should be in the Museum.

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### *PLANTÆ.*

*Araucarites Hudlestoni*, Carr:

Coralline Oolite, Malton.

W. Carruthers, Quart. Geo. Soc., vol. xxxiii. (1877), pl: xvii.,  
fig. 2, p. 402.



*Beania (Sphaereda) paradoxa*, L. & H.

Upper Shales. Gristhorpe.

Phillips. Geol: Yorks: Pt: I., pl: viii., fig: 2, p. 233.

(Originally described as "Winged seed.")

*Cyclopteris digitata*, Br:

(=*Sphenopteris latifolia*, Phil:)

Middle Estuarine. Scalby.

Phillips. Geol: Yorks: Pt: I., pl: vii., fig: 18, p. 200.

*Cyclopteris (Sphenopteris, Sagenopteris) longifolia*, Phil:

Middle Estuarine. Gristhorpe.

Phillips. Geol: Yorks: Pt: I., pl: vii., fig: 17.

*Glossopteris (Sagenopteris) Phillipsii*, Br:

(=*Pecopteris paucifolia*, Phil:)

Middle Estuarine. Gristhorpe.

Phillips. Geol: Yorks: Pt: I., pl: viii., fig: 8, p. 203.

*Lepidodendron Harcourti*, Lindl:

Coal Measures. Hesley Heath, Rothbury.

Lindley & Hutton. Foss: Flora, pl: 98, fig: 1, p. 45.  
(1833-5).

*Mantellia inclusa*, Carr:

Neocomian. Potton.

W. Carruthers. Trans: Linn: Soc: vol: xxvi. (1870),  
pl: lxiii., figs: 2, 3, p. 703.

*Pecopteris caespitosa*, Phil:

Middle Estuarine. Gristhorpe.

Phillips. Geol: Yorks: Pt: I., pl: viii., fig: 10, p. 207.

*Phlebopteris (Pecopteris) crenifolia*, Phil:

Middle Estuarine. Gristhorpe.

Phillips. Geol: Yorks: Pt: I., pl: viii., fig: 11., p. 202.

*Phlebopteris Phillipsii*, Br:

(=*Phyllites nervulosus*, Phil:)

Middle Estuarine. Gristhorpe.

Phillips. Geol: Yorks: Pt: I., pl: viii., fig: 9, p. 202.

*Pterophyllum (Aspleniopteris) Nilssoni*, Phil:

Middle Estuarine. Gristhorpe.

Phillips. Geol: Yorks: Pt: I., pl: viii., fig: 4.

(NOT *P. Nilssoni*, L. & H. See Geol: Yorks: p. 227).

*Pterophyllum (Cycadites) tenuicaule*, Phil :

Middle Estuarine. Gristhorpe.

Phillips. Geol : Yorks : Pt : I., pl : vii., fig : 19, p. 227.

*Sphenopteris muscoides*, Phil :

Lower Estuarine. Saltwick.

Phillips. Geol : Yorks : Pt : I., pl : x., fig : 10.

“Skeletonized Fern-branch.”

Middle Estuarine. Gristhorpe.

Phillips. Geol : Yorks : Pt : I. viii. 18.

“Small vegetable bodies.”

(*Sphaereda parva*), Bean.

Lower Estuarine. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : vii., fig : 25.

## PORIFERA.

*Cephalites (Spongia), Rennettiae*, Marl :

Chalk. Danes Dyke.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 4.

*Chenendopora (Spongia) convoluta*, Ph :

Chalk. Danes Dyke.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 6.

*Coscinopora (Millepora) globularis*, Ph :

Chalk. Danes Dyke.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 12.

*Coscinopora pilcolus*, Ph : (= *Lunulites urceolata*, Ph :)

Chalk. Danes Dyke.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 11.

*Coscinopora (Spongia) porosa*, Phil :

Chalk. Bridlington.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 8.

*Manon (Spongia) marginatum*.

Chalk. Danes Dyke.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 5.

\* *Manon (Spongia) osculiferum*, Ph :

Chalk. Danes Dyke.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 3.

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\* These specimens are not marked as figured, but they are most probably the originals of the references given with them.

*Rhaxella perforata*, Hinde.

Lower Calc. Grit. Scarborough.

Dr. E. J. Hinde. Quart: Journ: Geol: Soc: vol: xlvi.  
(1890), pl: vi., figs: 1, 2, p. 54 (two specimens).

This species includes *Spongia favosa*, Bean, and *Spongia striata*., Bean. The spicules have been described as *Geodites* (*Renulina*) *Sorbyana*, Blake.

“*Rhizo-spongia polymorpha*.”

Chalk. nr. Flamborough.

Charlesworth. Proc: Yorks: Phil: Soc: Vol: I., Pl: I.,  
figs: 1, 2, p. 73 (two specimens).

### ACTINOZOA.

*Montlivaltia* (*Caryophyllia*) *convexa*, Phil:

Dogger. Blea Wyke.

Phillips. Geol: Yorks: Pt: i., pl: xi., fig: 1.

*Palæacis* (*Hydriopora*, *Astræopora*, *Propora*) *cyclostoma*, Phil:

Carb. Limestone. Northumberland.

Phillips. Geol: Yorks: vol: II., pl: ii., figs: 9, 10, p. 202  
(misprinted *Hydnopora*).

*Trochocyathus* (*Caryophyllia*) *conulus*, Ph:

Speeton Clay. Speeton.

Phillips. Geol: Yorks: Pt: I., pl: ii., fig: 1.

### ECHINODERMATA.

*Astropecten clavæformis*, Wright.

Kelloway Rock. Newtondale.

Charlesworth. London Geol: Journal, pl: xvii.

(Figured as *Asterias arenicola*, Goldf. Horizon wrongly  
given as Calc: Grit).

Wright. Brit: Foss: Echin: (Pal: Soc:) vol: 2. (*Asteroidea*),  
pl: xi., fig: 1, p. 125.

*Astropecten clavæformis*, Wright.

Kelloway Rock. Newtondale.

Wright. Brit: Foss: Echin: (Pal: Soc:) vol: II.  
(*Asteroidea*), pl: xa., fig: 3. (wrongly given as fig: 2 in  
description of plate), p. 125.



*Astropecten Orion*, Forbes.

Kelloway Rock. Newtondale.

Wright. Brit: Foss: Echin: (Pal: Soc:) vol: 2, pl: xa.,  
fig: 1, p. 127.

*Astropecten rectus*, McCoy.

Lower Calc: Grit. Scarborough.

Wright. Brit: Foss: Echin: (Pal: Soc:) vol: II.  
(*Asteroidea*) pl: xii., fig: 1.

*Cidaris*, sp:

Dogger. Robin Hood's Bay.

Phillips. Geol: Yorks: Pt: I., pl: xi., fig: 2.

*Collyrites (Spatangus) ovalis*, Phil:

(= *Collyrites bicordata*, Leske).

Lower Calc: Grit. nr. Scarborough.

Phillips. Geol: Yorks: Pt: I., pl: iv., fig: 23.

*Echinus Henslowi*, Forbes.

Red Crag. Walton.

J. W. Gregory. Annual Report Yorks: Phil: Soc: 1890,  
Pl: I., figs: 2, 4, p. 40 (female form).

*Echinus paucimiliaris*, J. W. Gregory.

Red Crag. Butley.

J. W. Gregory. Annual Report Yorks: Phil: Soc: 1890,  
Pl: I., fig: 1, p. 39.

*Echinus sphaeroideus*, Cotteau.

Corralline Crag. Boyton.

J. W. Gregory. Annual Report Yorks: Phil: Soc: 1890,  
Pl: I., fig: 5, p. 41.

*Echinus woodi*, Desor:

Coralline Crag. Orford.

J. W. Gregory. Annual Report Yorks: Phil: Soc: 1890,  
Pl: I., fig: 8, p. 40.

*Hydreionocrinus Woodianus*, De Kon:

Carb: Limestone. Richmond.

De Koninck. The Geologist, Vol: I., pl: iv., fig: 5, p. 178.  
(From the Bull: Acad: Roy: Belg: II., Vol: 4).

*Millericrinus (Rhodocrinus) echinatus*, Goldf:

Coralline Oolite. Appleton.

Phillips Geol: Yorks: Pt: I., pl: iii., fig: 9.

*Ophioderma Milleri*, Phil :

Lias. (*Capricornus* Zone). Staithes.

Charlesworth. London Geol : Journ : (1847), Pl : VIII.

*Palæchinus sphæricus*, Scouler.

Carb. Limestone. Kirkby Stephen.

Geol : Mag : Vol : VII. (1870), pl : vii., fig : 1, p. 259.

*Pentacrinus gracilis*, Charlesworth.

Lias. (*Margaritatus* Zone). Staithes.

Charlesworth. London Geol : Journal : Pl : IX.

*Pygurus (Clypeaster) pentagonalis*, Phil :

Lower Calc : Grit. Scarborough.

Phillips. Geol : Yorks : Part I., pl : iv., fig : 24.

*Strongylocentrotus scaber*, J. W. Gregory.

Coralline Crag. Aldborough.

J. W. Gregory. Annual Report Yorks : Phil : Soc : 1890,  
Pl : I., fig : 7, p. 41.

*Woodocrinus expansus*, De Kon :

Carb. Limestone. Holgate, near Marske, Swaledale.

De Koninck. The Geologist, Vol : I., pl : ii., p. 12 (see also  
Brit : Ass : Report for 1857, p. 77).

*Woodocrinus macrodactylus*, De Kon :

Carb : Limestone. Holgate, near Marske, Swaledale.

De Koninck. The Geologist, Vol : I., pl : i., p. 12 (see also  
Brit : Ass : Report for 1857, p. 77).

## CRUSTACEA.

*Astacodes (Meyeria) falcifer*, Bell.

Speeton Clay. Speeton.

Bell. Brit : Foss : Crust : (Pal : Soc :) pl : ix., figs : 3 & 5,  
p. 30. (Two specimens)

NOTE.—Bell gives *M. falcifer* as Phillips species, but Phillips does not figure the species in the “Geology of Yorkshire.” Mr. James Carter considers the so-called *A. falcifer* a *Glyphæa*.

*Meyeria (Astacus) mucronata*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : iii., fig : 3.

Bell. Foss : Crust : (Pal : Soc :) pl : ix., fig : 6, p. 30 (Chela only).

Referred to by Bell as a very doubtful determination of Phillips'. According to Mr. J. Carter, it is probably a *Hoploparia*.

*Meyeria (Astacus) ornata*, Phil :

Speeton Clay. Speeton.

Bell. Brit : Foss : Crust : (Pal : Soc :) vol : IX., fig : 9, p. 33.

*Pollicipes concinnus*, Morris.

Oxford Clay. near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v, fig : 18 (possibly an *Aptychus*).

### POLYZOA.

*Hippothoa (Cellaria) Smithii*, Phil :

Cornbrash. near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : vii., fig : 8. (The Polyzoön is on the figured specimen of *Cardium citrinoides*).

### BRACHIPODA.

*Athyris planosulcata*, Phil :

Carb : Limestone. Bolland.

Davidson. Brit : Foss : Brach : (Pal : Soc :) vol : II., pl : xvi., fig : 4, p. 80.

\* *Cyrtina (Spirifer) septosa*, Phil :

Carb : Limestone.

Davidson. Brit : Foss : Brach : (Pal : Soc :) vol : II., pl : xiv., fig : 9, p. 68.

*Lingula parallela*, Phil :

Carb : Limestone. Harelaw.

Phillips. Geol : Yorks : Pt : II. xi. 17—19, p. 221.

Davidson. Brit : Foss : Brach : (Pal : Soc :) vol : II., pl : xlviii., fig : 35, pp. 207, 268. (Is a variety of *L. mytiloides*, Sow :

*Rhynconella lineolata*, Phil :

Speeton Clay. Knapton.

Phillips. Geol : Yorks : Pt : II., pl : ii., fig : 27.

Davidson. Brit : Foss : Brach : (Pal : Soc :) Vol : I., Cret : Mono : fig : xii., pl : 6, p. 98.

The specimen has more the appearance of a Red Chalk than of a Speeton Clay fossil.



\* *Rhynconella pleurodon*, Phil :

var : *Davreuniana*, De Kon :

Carb : Limestone. Gilling.

Davidson. Brit: Foss: Brach: (Pal : Soc :) Vol : II., pl : xxiii.,  
figs : 19, 20, 21, p. 101.

\* *Spirifer glabra*, Mart :

Carb : Limestone. Craven.

Davidson. Brit: Foss: Brach: (Pal : Soc :) vol : II., pl : xi.,  
figs : 1, 10, p. 59 (two specimens).

\* *Spirifera humerosa*, Phil :

Carb : Limestone. Wensleydale.

Davidson. Brit: Foss: Brach: (Pal : Soc :) vol : II., pl : iv.,  
fig : 16, p. 23.

\* *Spirifer Reedii*, Dav :

Carb : Limestone. Settle.

Davidson. Brit: Foss: Brach: (Pal : Soc :) vol : II., pl : v.,  
figs : 43—46, p. 43.

\* *Spirifer striata*, Mart :

Carb : Limestone. Craven.

Davidson. Brit: Foss: Brach: (Pal : Soc :) vol : II., pl : ii.,  
fig : 17, p. 19.

\* *Spirifer striata*, Mart :

Carb : Limestone. Craven. (Locality given as *Richmond* in  
Davidson's monograph).

Davidson. Brit: Foss: Brach: (Pal : Soc :) vol : II., pl : iii.,  
fig : 4, p. 19.

\* *Spirifer triangularis*, Mart :

Carb : Limestone.

Davidson. Brit: Foss: Brach: (Pal : Soc :) vol : II., pl : v.,  
figs : 18—21, p. 27.

*Spirifer triradialis*, Phil : (var. *sexradialis*, Phil :)

Carb : Limestone. Craven.

Davidson. Brit: Foss: Brach: (Pal : Soc :) Vol : II., pl : ix.,  
fig : 11, p. 49.

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\* These specimens are not marked as figured, but they are most probably the originals of the references given with them.

*Terebratula grandis*, Blum :

Red Crag. Waldringfield.

Sup : Crag. Moll : Pl : VIII., fig : 11 *a b c*, p. 168 (three specimens).

*Terebratula semiglobosa*, Sow :

(*Terebratula subundata*, Sow :)

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 26.

*Terebratula vesicularis*, De Kon :

Carb : Limestone. Craven.

Davidson. Brit : Foss : Brach : (Pal : Soc :) Vol : II., pl : i. xxv., pp. 15, 215, all through.

*Terebratula vesicularis*, De Kon :

Carb : Limestone. Craven (locality given as *Wensleydale* in Davidson's Monograph).

Davidson. Brit : Foss : Brach : (Pal : Soc :) Vol : II., pl : ii., figs : 1, 2, 3, 4, and 6., pp. 15, 215.

*Terebratulina striata*, Wahl :

(*Terebratula pentagonalis*, Phil :)

Chalk. Yorkshire.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 17.

### LAMELLIBRANCHIATA.

*Arca tetragona*, Poli :

Cor : Crag. Sutton.

S. V. Wood. 2nd Sup : Crag. Moll : Pl : VI., fig : 8*b*, p. 44.

(This specimen has received the provisional names of *A. nodulosa*, Müll : and *A. puella*, A. Bell).

*Astarte paupertina*, Bean.

(Figured as *Astarte*, sp :)

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., figs : 10, 11.

*Astarte (Pullastra) recondita*, Phil :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., ix., 13.

*Avicula elegantissima*, Bean.

Coralline Oolite. Malton.

Phillips. Geol : Yorks : Pt : I., pl : iv., fig : 2.

*Cardinia (Pullastra) antiqua*, Phil :

Lias (*Margaritatus* Zone). Robin Hood's Bay.

Phillips. Geol : Yorks : Pt : I., pl : xiii., fig : 16 (called *P. prototypa* in letterpress of 2nd Edition [p 133], and *C. crassiuscula* in 3rd Edition, [p. 254]).

*Cardium citrinoideum*, Phil :

Cornbrash. Near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : vii., fig : 7.

*Cardium cognatum*, Phil :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 14.

*Cardium fallax*, Phil : (= *C. dissimile*, Phil :

Kelloway Rock. Near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 27.

*Cardium gibberulum*, Phil :

Yellow Sands. Glaizedale.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 8.

*Cardium incertum*, Phil :

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 5.

*Cardium multcostatum*, Phil :

Lias (*Spinatus* Zone). Lofthouse.

Phillips. Geol : Yorks : Pt : I., pl : xiii., fig : 21.

*Cardium semiglabrum*, Phil :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 15.

*Cardium striatulum*, Sow :

Dogger. Robin Hood's Bay.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 7.

*Corbicella (Corbis) ovalis*, Phil :

Kelloway Rock. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 29.

*Cucullæa cancellata*, Phil :

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 44.

*Cucullæa concinna*, Phil :

Oxford Clay. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 9.



*Cucullæa imperialis*, Bean.

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 19.

*Cucullæa pectinata*, Phil :

Coralline Oolite. Malton.

Phillips. Geol : Yorks : pl : iii., fig : 32.

*Cucullæa reticulata*, Phil :

Dogger. Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 18.

*Cucullæa securis*, Leym :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 16.

*Cultellus Suttonensis*, S. Wood

Coralline Crag. Sutton.

S. V. Wood. Crag Moll : Sup : pl : x., fig : 15, p : 148.

*Cypricardia cordiformis*, Desh :

(= *Cardium acutangulum*, Phil :

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 6.

*Cytherea dolabra*, Phil :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 12.

*Delphinula inconspicua*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 32.

*Gervillia lata*, Phil :

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 16.

*Isocardia angulata*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., figs : 20, 21 (two specimens).

*Isocardia nitida*, Phil :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 10.

*Leda anglica*, D'Orb : (= *L. lachryma*, Phil :)

Dogger. Robin Hood's Bay.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 14.

*Lima duplicata*, Sow :

Kelloway Rock. Near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : vi., fig : 2.

*Lima squamosa*, Lamarek.

Cor : Crag. Orford.

S. V. Wood. Crag Moll : Supplement, Pl : X., fig : 1*b*, p. 109.

*Lima (Plagiostoma)*, sp :

Lias (*Jamesoni* Zone), Peak.

Phillips. Geol : Yorks : Pt : I., pl : xiv., fig : 18 (is most probably *L. Hermannii* Volz. To the same species should be referred *P. rusticum*, Y. and B.)

*Lucina crassidens*, S. Wood :

Red Crag Waldringfield.

S. V. Wood. Crag Moll : 2 Sup : Pl : V., fig : 4, p. 45.

*Lucina despecta*, Phil :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 8.

*Macrodon Hirsonensis*, D. Ach :

(= *Culcullæa elongata*, Sow :)

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 43.

*Maetra ponderosa* ? Stimpson.

Red Crag. Waldringfield.

S. V. Wood. Crag Moll : 2nd Sup : pl : vi., fig : 2, p. 47.

*Modiola furcata*, Goldf :

(= *M. aspera*, Sow :)

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 9.

*Modiola pulchra*, Phil :

Kelloway Rock. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 26.

*Monotis Garforthensis*, King.

Magnesian Limestone. Garforth.

King. Perm : Foss : (Pal : Soc :) pl : xiii., fig : 24, p. 157

*Mya phaseolina*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 13.

*Mya*, sp :

Kelloway Rock. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 23.

*Myacites (Mya) calceiformis*, Phil :

Dogger.\* Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 3.

*Myacites (Mya) equatus*, Phil :

Dogger. Robin Hood's Bay.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 12.

*Myacites recurvus*, Phil :

Kelloway Rock. Scarborough.

Phillips : Geol : Yorks : Pt : I., pl : v., fig : 25.

*Neæra obesa*, Loven.

Coralline Crag. Orford.

S. V. Wood. Crag Moll : Supp : pl : x., fig : 9, p. 161.

*Nucula brevirostris*, Phil :

Carb : Limestone. Harelaw, Northumberland.

Phillips. Geol : Yorks : vol : II., pl : v., fig : 11a, p. 210.

*Nucula elliptica*, Phil :

Oxford Clay. Near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 6.

*Nucula ovata*, Mant : (= *N. obtusa*, Sow :)

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 10.

*Nucula subrecurva*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 11.

*Nucula turgens*, S. Wood.

Red Crag. Waldringfield.

S. V. Wood. Crag Moll : 2nd Sup : Pl : V., fig : vi., p. 44.

*Nucula variabilis*, Sow :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I : pl : ix., fig : 11.

*Nucula*, sp :

Oxford Clay. Scarborough.

Phillips. Geol : Yorks : Part I., pl : v., fig : 4 (probably

*N. turgida*, Bean, M S.)

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\* ? Cornbrash.



*Ostrea undosa*, Bean.

Kelloway Rock. Near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : vi., fig : 4.

*Pecten inæquitostatus*, Ph :

Coralline Oolite. Malton.

Hudleston. On the Yorkshire Oolites. Proc : Geol : Ass :

Vol : V., (1876-78), Pl : V., fig : 16, p. 478.

*Pholadomya decussata*, Phil :

Kimmeridge Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 9,

*Pholas cylindrica*, J. Sow :

Red Crag. Walton.

S. V. Wood. Crag Moll : 2nd Sup : Pl : V., fig : 5, p. 49

(given as *P. dactylus* by Mr. Bell in Proc : Geol : Assoc :

Vol : II., No : 5, p. 26).

\**Pholas recondita*, Phil :

Coral Rag. Malton.

Phillips. Geol : Yorks : Pt : I., pl : iii., fig : 10.

*Pinna (Modiola) granulosa*, Phil :

Carb : Limestone. Northumberland.

Phillips. Geol : Yorks : Vol : II, pl : v., fig : 23, p. 210.

*Pinna mitis*, Phil :

Oxford Clay. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 7.

*Quenstedtia (Psammobia) lævigata*, Phil :

Coralline Oolite. Malton.

Phillips. Geol : Yorks, Pt : I., pl : iv., fig : 5.

*Quenstedtia lævigata*, Phil :

Coralline Oolite. Malton.

W. H. Hudleston. Proc : Geol : Assoc : Vol : V. (1876—8),

pl : iv., fig : 9, p. 476.

*Quenstedtia lævigata*, Phil : var : *gibbosa*.

Coralline Oolite. Malton.

W. H. Hudleston. Proc : Geol : Assoc : Vol : V. (1876—8),

pl : iv., fig : 10, p. 476.

*Quenstedtia (Pullastra) oblita*, Phil :

Dogger. Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 15.

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\* Not marked as figured.

*Tancredia (Nucula) axiniformis*, Phil :

Dogger. Robin Hood's Bay.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 13.

\* *Tellina*, sp :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 7.

*Thracia phillipsii*, Röm : (*Mya depressa*, Phil :)

Kimmeridge Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 8.

*Unicardium (Corbula) cardiodes*, Phil :

Lias. (*Jamesoni* Zone). Robin Hood's Bay.

Phillips. Geol : Yorks : Pt : I., pl : xiv., fig : 18.

### GASTEROPODA.

*Actæon* (?) *Etheridgii*, A. Bell.

Red Crag. Walton.

S. V. Wood. Crag Moll : Sup : pl : v., fig : 17, p. 94.

*Actæonina humeralis*, Phil.

Dogger. Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 34.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 2, pl : v.,  
fig : 1, p. 202.

*Actæonina humeralis*, Phil :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 2, pl : v.,  
fig . 3, p. 202.

*Actæonina (Auricula) Sedgwicki*, Phil :

Dogger. Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 33.

*Alaria bispinosa*, Phil :

Kelloway Rock. Near Scarborough.

W. H. Hudleston. Geol : Mag : Dec : III., vol : i., pl : vi.,  
fig : 7, p. 151.

*Alaria unicarinata*, Hud :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : I., pl : vi.,  
fig : 1, p. 149.

*Avellana (Auricula) obsoleta*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii, fig : 40.

*Buccinum Dalei*, Sow :

Cor : Crag. Boyton.\*

S. V. Wood. Crag Moll : 2nd Sup : pl : I., fig : 2, p. 2.

*Buccinum pseudo-Dalei*, S. Wood.

Cor : Crag. Near Orford.

S. V. Wood. Crag Moll : Sup : pl : v., fig : 4, p. 17.

*Buccinum undatum*, ? Linn :

Red. Crag. Butley.

S. V. Wood. Crag Moll : 2nd Sup : pl I., fig : 5, p. 1.

*Bulla utriculus*, ? Broc :

Cor : Crag. Near Orford.

S. V. Wood. Crag Moll : Sup : Addendum, pl : fig : 26, p. 187.

*Cancellaria (Admete) avara*, ? Say :

Red Crag. Waldringfield.

S. V. Wood. Crag Moll : 2nd Sup : pl : iv., fig : 5, p. 22.

*Cancellaria contorta*, ? Bast.

Cor : Crag. Gedgrave ("near Orford" in explanation to Plate).

S. V. Wood. Crag Moll : Sup : Pl : VI., fig : 19.

*Cancellaria subangulosa*, S. Wood.

Cor : Crag. Near Orford.

S. V. Wood. Crag Moll : Sup : Pl : III., fig : 27, p. 47  
(described by A. Bell as *Admete Reedii*, A. Bell : Ann : and  
Mag : Vol : VI. (1870), p. 213).

*Cancellaria (Admete) viridula*, Fab : var : *Couthouyi*.

S. V. Wood. Crag Moll : Sup : Pl : VI., fig : 10, p. 97.

*Cerithium Beanii*, Mor : & Lye :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., Vol : I., pl : iii.,  
fig : 10.

*Cerithium Beanii*, Mor : & Lye :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., Vol : I., pl : iii.,  
fig : 11.

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(\* Given as *Sutton* in the Crag Moll :)



*Cerithium gradatum*, Hud :

Coral Rag. Yorkshire.

W. H. Hudleston. Geol : Mag : Vol : VII., 1880, pl : xvi.,  
fig : 5, p. 484.

*Cerithium muricatum*, Sow : var : *trilineatum*.

Grey Limestone. Cloughton Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., Vol : I., pl : iii.,  
fig : 6, p. 51.

*Cerithium (Triforis) perversum* ? Linn :

Cor : Crag. Sutton.

S. V. Wood. Crag Moll : Sup : Addendum Plate, fig : 17,  
p. 181.

*Chemnitzia plicatula*, (?) Brocchi.

Red Crag. Butley.

S. V. Wood. Crag : Moll : Sup : pl : vii., fig : 3, p. 61.

*Columbella abbreviata*, A. Bell.

Red Crag. Foxhall.

S. V. Wood. Crag Moll : 3rd Sup : pl : i., fig : 3, p. 6.

*Columbella Borsoni*, ? Bellardi.

Red Crag. Walton.

S. V. Wood. Crag Moll : Sup : Addendum Plate, fig : 19,  
p. 174.

*Columbella minor*, Scacchi.

Cor : Crag. Near Orford.

S. V. Wood. Crag Moll : Sup : Addendum Plate, fig : 20,  
p. 174.

*Columbella ? (Astyris) sulcata*, S. Wood.

Red Crag. Shottisham.

S. V. Wood. Crag Moll : 2nd Sup : pl : i., fig : 3, p. 4.

*Eulima robusta*, A. Bell.

Red Crag. Waldringfield.

S. V. Wood. Crag Moll : 2nd Sup : Pl : IV., fig : 17 : p. 28.

*Eulima similis*, D'Orb :

Red Crag. Walton.

S. V. Wood. Crag Moll : Sup : Pl : VII., fig : 16, p. 65.

*Fissurella costaria*, Bast :

Cor : Crag. Sutton.

S. V. Wood. Crag Moll : Sup : Pl : VII., fig : 19, p. 90.

*Fusus crispus* ? Borson.

Red Crag. Sutton.

S. V. Wood. Crag Moll : Sup : Pl : II., fig : 10, p. 29.

*Fusus Largillierti*, Fisch.

Red Crag.

S. V. Wood. Crag Moll : Sup : Add : Pl : fig : 16, p. 177

(considered by S. Wood to be *Trophon Norvegicus*).

*Fusus nodifer*, A. Bell.

Red Crag. Waldringfield.

S. V. Wood. Crag Moll : 2nd Sup : Pl : III., fig : 4, p. 12.

*Fusus Waelii*, Nyst :

? Cor : Crag. Boyton.

S. V. Wood. Crag Moll : 2nd Sup : Pl : I., figs : 10*a*, 10*b*, 10*c*,  
p. 9 (two specimens).

*Lachesis anglica*, A. Bell.

Cor : Crag. Near Orford.

S. V. Wood. Crag Moll : Sup : Addendum Plate, fig : 7,  
p. 175.

*Limnæa Pingelii* (?), Möll.

Red Crag. Butley.

S. V. Wood. Crag : Moll : Sup : Pl : iv., fig : 4, p. 3.

*Littorina*, sp :

Dogger. Robin Hood's Bay.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 1, pl : viii.,  
fig : 2, p. 243.

*Menestho Britannica*, A. Bell.

Cor : Crag. Sutton.

S. V. Wood. Crag Moll : Sup : Addendum Plate, fig : 21,  
p. 185.

*Murex inculptus*, Dujard. ?

Red Crag. Waldringfield.

S. V. Wood. Crag Moll : Sup : Add : Plate, fig : 9, p. 176.

*Murex pseudo-Nystii*, S. Wood.

? Cor : Crag. Boyton.

S. V. Wood. Crag Moll : 2nd Sup : pl : I., fig : 8.

*Murex Reedii*, S. Wood.

? Cor : Crag. Boyton.

S. V. Wood. Crag Moll : 2nd Sup : pl : I., fig : 9, p. 13.

*Nassa densicostata*, A. Bell.

Cor : Crag. Near Orford.

S. V. Wood. Crag Moll : Sup : pl : vi., fig : 8, p. 13.

*Natica (Amauropsis) Japonica*, A. Adams.

Red Crag. Butley.

S. V. Wood. Crag Moll : 2nd Sup : pl : III, fig : 11, p. 30.

*Nassa pulchella*, Andrz :

Cor : Crag. Near Orford.

S. V. Wood. Crag Moll : Sup : pl. vi., fig : 7, p. 13.

*Nassa pusillina*, S. Wood.

(=*N. cuvieri*, Payr :)

Norwich Crag. Butley.

S. V. Wood. Crag Moll : Sup : Add : Pl : fig : 24, p. 176.

(Given as *Red Crag* in S. Wood).

*Nassa reticosa*, Sow : (var : *simplex*).

Red Crag. Butley.

S. V. Wood. Crag Moll : Sup : pl : iv., fig : 3, p. 15.

*Natica arguta*, Phil :

Coral Rag. Malton.

W. H. Hudleston. Geol : Mag : vol : VII. (1880), pl : ix.,  
fig : 4, p. 296.

*Nerinea cingenda*, Phil :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : I., pl : iv.,  
fig : 5.

*Nerinea Goodhallii*, Sow :

Coral Rag. Malton.

W. H. Hudleston. Geol : Mag : vol : VII. (1880), pl : xvii.,  
fig : 4, p. 531.

*Nerinea visurgis* (non Røem :)

Coral Rag. Seamer.

W. H. Hudleston. Proc : Geol : Assoc : vol : V., pl : iv., 1a,  
p. 475.

*Nerinea*, sp :

Millepore Oolite. Whitwell.

W. H. Hudleston. Geol : Mag : Dec : III., vol : I., pl : iv.,  
fig : 7, p. 112.



*Neritopsis lævigatus*, Phil :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 2, pl : ii.,  
fig : 3, p. 49.

*Neritopsis (c.f.) Bajocensis*, D'Orb :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : I., pl : ix.,  
fig : 11, p. 300.

*Nerita minuta*, Sow : (= *Natica tumidula*, Phil :)

Dogger. Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 25.

W. H. Hudleston. Geol : Mag : Dec : III., vol : I., pl : ix.,  
fig : 6, p. 296.

*Odostomia albella*, Loven.

Cor : Crag. Sutton.

S. V. Wood. Crag Moll : Sup : Addendum Plate, fig : 15,  
p. 184.

*Phasianella cincta*, Phil :

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 29.

*Pleurotoma pyramidalis*, Ström :

Norwich Crag. Thorpe, Suffolk.

S. V. Wood. Crag Moll : Sup : pl : III., fig : 9, p. 43.

(Wrongly given in text as from Butley).

*Pleurotomaria (c.f.) anglica*, Sow :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 2, pl : iv.,  
fig : 5, p. 154.

*Pleurotomaria (Cirrus) cingulata*, Phil :

Lower Calc : Grit. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : iv., p. 28.

*Pleurotomaria (Cirrus) depressa*, Phil :

Kelloway Rock. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : vi., fig : 12.

*Pleurotomaria depressa*, Phil :

Oxford Clay. Near Scarborough.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 2, pl : iv.,  
fig : 1, p. 151.

*Pleurotomaria granulata*, Lycett.

Oxford Clay. Near Scarborough.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 2, pl : iii.,  
fig : 10, p. 127.

*Pleurotomaria (Turbo) undulatus*, Phil :

Lias (*Capricornus* Zone). Peak.

Phillips. Geol : Yorks : Pt : I., pl : xiii., fig : 18.

*Purpuroidea nodulata*, Y. & B.

Coral Rag. Langton Wold.

W. H. Hudleston. Geol : Mag : vol : VII. (1880), pl : viii.,  
figs : 1 & 2, p. 289 (2 specimens).

*Ranella ? Anglica*, A. Bell.

Red Crag. Waldringfield.

S. V. Wood. Crag Moll : 2nd Sup : pl : iii., fig : 3, p. 16.

*Rissoa costulata*, Alder.

Cor : Crag. Sutton.

S. V. Wood. Crag Moll : 2nd Sup : pl : iv., fig : 23, p. 29.

*Rissoa reticulata*, Mont :

Cor : Crag. Sutton.

S. V. Wood. Crag Moll : 2nd Sup : pl : iv., fig : 19, p. 30.

*Scalaria Turtoni*. Turton.

Chillesford Beds.

Sudbourn Church Walks.

S. V. Wood. Crag Moll : Sup : pl. iv., fig : 7, p. 58.

*Scalaria Turtoni*. Turton.

var : *pseudo-Turtoni*.

Chillesford Beds.

Sudbourn Church Walks.

S. V. Wood. Crag Moll : Sup : pl : iv., fig : 5, p. 58.

(Only the last whorl of a shell).

*Scalaria semicostata*, Sow :

Red Crag. Woodbridge.

S. V. Wood. Crag : Moll : Sup : Add : pl : fig : 1, pp. 98,  
183. (Probably derivative).

*Solarium tabulatum*. Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 36.

*Trochotoma (Solarium) calyx*, Phil :

Dogger. Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 30.

W. H. Hudleston. Geol : Mag : Dec : III., Vol : II., pl : iv.,  
fig : 6, p. 156.

*Trochus monilitectus*, Bean.

Grey Limestone. Cloughton Wyke.

Phillips. Geol : Yorks : Pt : I., pl : ix., fig : 33.

*Trochus (Onustus) pyramidatus*, Phil :

Dogger. Blea Wyke.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 22.

*Trophon altus*, S. Wood. var : *bucciniformis*.

Red Crag. Butley.

S. V. Wood. Crag Moll : Sup : pl : ii., fig : 17*b*, p. 23.

*Trophen elegans*, ? Charlesworth.

Red Crag. Butley.

S. V. Wood. Crag Moll : Sup : Pl : II., fig : vi., p. 22.

*Trophen propinquus*, Alder.

Red Crag. Waldringfield.\*

S. V. Wood. Crag Moll : Sup : pl : II., 15*a*, p. 24.

*Turbo (Delphinulus) granatus*, Hud :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec. III., Vol : II., pl : ii.,  
fig : 11, p. 55.

*Turbo (Monodonta) lævigatus*, Sow :

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : 2, pl : ii.,  
fig : 4, p. 52.

*Turbo melanoides*, Bean, M.S.

Dogger. Blea Wyke.

W. H. Hudleston. Geol : Mag : Dec : III., vol : I., pl : viii.,  
fig : 12, p. 251.

*Turbo sulcostomus*, Phil :

Kelloway Rock. Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : vi, fig : 10.

*Turritella (Mesalia) penepolaris*, S. Wood.

? Cor : Crag. Boyton.

S. V. Wood. Crag Moll : 2nd Sup : pl : ii., fig : 14, p. 26.

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(\* Given as Butley in Crag Moll :)



*Turritella quadrivittata*, Phil :

Dogger. Peak.

Phillips. Geol : Yorks : Pt : I., pl : xi., fig : 23.

W. H. Hudleston. Geol : Mag : Dec : III., vol : I., pl : vii.,  
figs : 11, 12, p. 202.

### CEPHALOPODA.

*Ammonites concinnus*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 47.

*Ammonites hystrix*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 44.

*Ammonites marginatus*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 41.

*Ammonites nucleus*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 43.

*Ammonites oculatus*, Phil :

Oxford Clay. Near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 16.

\**Ammonites planus*, Mant :

Speeton Clay. Speeton

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 42.

*Ammonites rotula*, Sow :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 45.

*Ammonites venustus*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : ii., fig : 48.

*Ancylloceras (Hamites) Beanii*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 28.

*Ancylloceras (Hamites) Phillipsii*, Bean.

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 30.

*Aptychus (Trigonellites) antiquatus*, Phil :

Lower Calc : Grit. Lyons Pit, Malton.

Phillips. Geol : Yorks : Pt : I., pl : iii., fig : 26.

*Goniatites evolutus*, Phil :

Carb : Limestone. Flaxby.

Phillips. Geol : Yorks : Pt : II., pl : xx., fig : 66, p. 237.

*Hamites armatus*, Sow :

Lower Chalk. Hamsey, Sussex.

Mantell's Geology of Sussex (1822), pl : xvi., fig : 5, p. 121.

*Hamites alternatus*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : i., figs : 26, 27 (two specimens).

*Hamites intermedius*, Phil :

Speeton Clay. Speeton.

Phillips. Geol : Yorks : Pt : I., pl : i., fig : 22.

*Orthoceras (Gyroceras) rugosum*, Flem :

Carb : Limestone. Northumberland.

Phillips. Geol : Yorks : vol : II., pl : xxi., fig : 16, p. 239.

## PISCES.

*Cladodus mirabilis*, Ag : (*C. mucronatus*, Davis).

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl : xlix., fig : 21, p. 380.

Quart : Journ : Geol : Soc : Vol . XL. (1884), pl : xxvii., fig : 10, p. 619 (tooth).

*Cladodus striatus*, Ag : (*C. elongatus*, Davis).

Carb : Limestone. Richmond and Settle

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl : xlix., figs : 10, 11, p. 374 (teeth, two specimens).

*Cladodus striatus*, Ag :

(*C. Hornei*, Davis.)

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl : xlix., fig : 20, p. 380.

Quart : Journ : Geol : Soc : Vol : XI. (1884), pl : xxvii., fig : 11, p : 619.

*Cladodus striatus*, Ag : (*C. curtus*, Davis.)

Carb : Limestone. Richmond.

J. W. Davis. Trans : Roy : Dublin Soc : (2), Vol : I., pl : xlix., fig : 19, p. 379 (tooth).

*Copodus (Psammodus) cornutus*\*, Ag :

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvii., fig : 22, p. 623.

*Ctenodus interruptus*, Barkas.

Coal Measures. Gilmerton.

A. S. Woodward. Ann : Rep : Yorks : Phil : Soc : 1889, pl : i., fig : 2, p. 37.

*Ctenoptychius lobatus*, Etheridge. (*Ctenopetalus crenatus*, Davis).

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl : lxi, fig : 9, p. 513.

Also another specimen of the above species from the same horizon and locality, figured by J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884) pl : xxvii., fig : 18, p. 623 (tooth).

*Ctenoptychius (Petalodopsis) tripartitus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I. (1883) pl : lx., fig : 6, p. 499. (Generic name mis-printed *Petalopsodus* in explanation of plate).

Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvi., fig : 16, p. 622 (tooth).

*Cyrtonodus gibbus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvii., figs : 1, 6, p. 631 (teeth : two specimens).

*Diclitodus scitulus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2), Vol : I. (1883), pl : li., fig : 29, p. 410.

Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvii., fig : 12, p. 623 (tooth).

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\* Should be *C. Spatulatus* : see Woodward & Sherborn, Brit : Foss : Vert : p. 46 (tooth).



*Dicrenodus (Pristicladodus) dentatus*, Mc'Coy.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans: Roy: Dublin Soc: (2), Vol: I.,  
pl: xlix., fig: 22, p. 384.

Quart: Journ: Geol: Soc: Vol: XL. (1884), pl: xxvii., 4,  
p. 620 (tooth).

*Deltoptychius plicatus*, Davis.

(? = *D. acutus*, McCoy.)

Yoredale Rocks. Leyburn.

J. W. Davis. Quart: Journ: Geol: Soc: Vol: XL., pl: xxvi.,  
fig: 13, p. 628 (tooth).

*Diplacodus bulboides*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart: Journ: Geol: Soc: Vol: XL. (1884),  
pl: xxvii., fig: 20, p. 633. (Tooth: imperfect).

*Dorypterus Hoffmanni*, Germar.

Marl Slate. Midderidge.

Hancock and Howse. Quart: Journ: Geol: Soc: Vol:  
XXVI. (1870), pl: xliii., fig: 1, p. 623, and Nat: Hist:  
Trans: North: and Durham (1872), pl: x., fig: 1, p. 243.

*Echinodus paradoxus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart: Journ: Geol: Soc: Vol: XL. (1884),  
pl: xxvii., fig: 7, p. 631. (Tooth).

*Edaphodon Reedii*, E. T. Newton.

Upper Greensand. Cambridge.

Chinæroid Fishes Brit: Cret: Rocks. (Mem: Geol: Surv:  
Mono: iv.), pl: vi., fig: 1, p. 19 (Left ramus of mandible).

*Edaphodon Reedii*, E. T. Newton.

Upper Greensand. Cambridge.

Chinæroid Fishes Brit: Cret: Rocks. (Mem: Geol: Surv:  
Mono: iv.), pl: vi., fig: 6, p. 19 (Right premaxilla).

*Edaphodon Reedii*, E. T. Newton.

Upper Greensand. Cambridge.

Chinæroid Fishes Brit: Cret: Rocks. (Mem: Geol: Surv:  
Mono: iv.), pl: vi. fig: 2, p. 19 (Left maxilla).

*Edaphodon Sedgwickii*, Ag :

Upper Greensand. Cambridge.

Chinæroid Fishes Brit : Cret : Rocks. (Mem : Geol : Surv :  
Mono : iv.) pl : ii., fig : 6, p. 7. (Mandible).

*Edaphodon Sedgwickii*, Ag :

Upper Greensand. Cambridge.

Chimæroid Fishes. Brit : Cret : Rocks. (Mem : Geol : Surv :  
Mono : IV.) ii., 10, p. 7. (Right ramus of manbible).

*Erismacanthus Jonesii*, McCoy.

(*Cladacanthus paradoxus*, Davis).

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : vol : xl. (1884),  
pl : xlv., figs : 1, 2, 3, 4, 5, p. 617.

(Imperfect spines : five specimens).

*Gomphacanthus acutus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : vol : xl. (1884),  
pl : xxvi., fig : 9, p. 618 (Spine).

*Glyphanodus tenuis*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : [2] vol : I. (1883),  
pl : xlix., figs : 24, 25, p. 386 (teeth : two specimens).  
Quart : Journ : Geol : Soc : vol : xl. (1884), pl : xxvii.,  
fig : 8, p. 621. (This is the former of the two specimens  
referred to above).

*Helodus (Lophodus) angularis*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : vol : xl. (1884),  
pl : xxvii., fig : 25, p. 628.

*Helodus (Lophodus) bifurcatus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : [2] vol : I., pl : li.,  
fig : 25, p. 408.

Quart : Journ : Geol : Soc : vol : xl. (1884), pl : xxvii., fig : 5  
(tooth).

*Helodus (Lophodus) conicus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : vol : xl. (1884),  
pl : xxvi., fig : 18, p. 627 (tooth).

*Helodus (Lephodus) levis*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : [2] vol : i , pl : li.,  
fig : 22, p. 407.

Quart : Journ : Geol : Soc : vol : xl. (1884), pl : xxvii., fig : 2,  
p. 626 (tooth).

*Hybodus delabechii*, Charlesworth.

Lower Lias. Lyme Regis.

A. S. Woodward. Ann : Rep : Yorks : Phil : Soc : 1888,  
pl : I., p. 58.

*Hybodus obtusus*, Ag :

Coral Rag. N. Grimston.

H. M. Platnauer. Ann : Rep : Yorks : Phil : Soc : 1887,  
pl : I., fig : 15, p. 35.

*Hybodus obtusus*, Ag :

Coralline Oolite. Malton.

H. M. Platnauer. Ann : Rep : Yorks : Phil : Soc : 1887,  
pl : I., figs : 2, 4, 12, 14, p. 35 (detached teeth).

*Ischyodus incisus*, E. T. Newton.

Upper Greensand. Cambridge.

Chimæroid Fishes. Brit : Cret : Rocks. (Mem : Geol : Surv :  
Mono : IV.), pl : xii., fig : 9, p. 38. Left ramus of mandible.

*Megalichthys Hibberti*, Ag :

Yoredale Series. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : vol : xl. (1884),  
pl : xxvi , fig : 8, p. 633.

*Notidanus gigas*, Sism :

Red Crag. Woodbridge.

A. S. Woodward. Geol : Mag : June, 1886, p. 255, fig : 1.  
Ann : Report Yorks : Phil : Soc : 1886, pl : I., fig : 4.

*Notidanus gigas*, Sism :

Red Crag. Suffolk.

A. S. Woodward. Geol : Mag : June, 1886, p. 256, fig : 2  
(woodcut), and Ann : Report Yorks : Phil : Soc : 1886,  
pl : I., fig : 5 (tooth).

The specimen was figured as *N. Meneghenii*, Lawley.



*Notidanus primigenius*, Ag :

Red Crag. Woodbridge.

A. S. Woodward. Geol : Mag : Decade III. May (1886),  
vol : 4, pl : vi., fig : 21 (p. 216).

*Orodus Reedi*, Davis.

Carb : Limestone. Settle.

J. W. Davis. Trans : Roy : Dublin Soc : [2] vol : I., pl : li.,  
fig : 13, p. 398 (tooth).

*Palæoniscus (Acentrophorus) glaphyrus*, Ag :

Marl Slate. Near Durham.

Agassiz. Poiss : Foss : Vol : II., pl : 10c, fig : 1, p. 98.

King. Permian Foss : (Pal : Soc :) pl : xxii., fig : 3, p. 224.

*Petalodus acuminatus*, Ag :

Carb : Limestone. Richmond.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I.,  
lix., figs : 22, 23, p. 494 (teeth : two specimens).

*Petalodus acuminatus*, Ag :

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884),  
pl : xxvi., fig : 10, p. 624 (tooth).

*Petalodus (Chomatodus) lamelliformis*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884),  
pl : xxvii., fig : 23, p. 625.

*Petalorhynchus*, sp :

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884),  
pl : xxvii., fig : 9 (tooth).

*Physonemus hamatus*, Ag :

Yoredale Series. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884),  
pl : xxvi., fig : 6, p. 617 (spine).

*Platysomus striatus*, Ag :

Marl Slate. Thrislington Gap.

King. Permian Foss : (Pal : Soc :) pl : xxviii., fig : 1, p. 231.

*Pleuracanthus lævissimus*, Ag :

Coal Measures. Dudley.

Agassiz. Poiss : Foss : Vol : III., pl : xlv., fig : 4, p. 66  
(spine).

*Pleuroplax (Pleurodus) woodi*, Davis.

Yoredale Rock. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (1) Vol : 1 (1883),  
pl : lix., figs : 12, 13, 14, 15, p. 458.Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvii.,  
figs : 14, 15, 16, 17 (teeth : six specimens).*Pæcilodus Jonesii*, Ag : (*P. corrugatus*, Davis),

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : 1.,  
pl : liii., fig : 25, p. 444.Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xvii.,  
fig : 21, p. 625 (tooth : imperfect).*Polyrhizodus Colei*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884),  
pl : xxvii., fig : 13, p. 622 (tooth).*Pristodus (Pristicladodus) concinnus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2), Vol : I. (1884),  
pl : xlix., fig : 23, p. 385.Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvi.,  
fig : 15, p. 621 (tooth, imperfect).*Pristodus falcatus*, Ag :

Carb : Limestone. Richmond.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl :  
lxi., fig : 17, p. 519 (tooth).*Pristodus falcatus*, Ag :

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl :  
lxi., figs : 18, 19, 22, p. 519.Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvi.,  
figs : 18, 19 (teeth : three specimens).*Psammodus (Astrabodus) expansus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884),  
pl : xxvi., figs : 11, 12, p. 630 (teeth : two specimens).

*Psephodus (Lophodus) sinuosus*, Davis.

Yoredale Rock. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2), Vol : I., pl : li., fig : 28, p : 409 (tooth).

*Ptychodus mammillaris*, Ag :

Chalk. Near Rochester.

A. S. Woodward. Ann : Rep . Yorks : Phil : Soc : pl : i., figs : 3—14, p : 39. (12 specimens of teeth).

*Ptychodus polygyrus*, Ag :

Chalk. Between Folkestone and Dover.

A. S. Woodward. Ann : Rep : Yorks : Phil : Soc : 1889, pl : i., figs : 15—20, p. 40 (6 teeth).

*Pygopterus mandibularis*, Ag :

Marl Slate. Thrislington Gap.

King. Permian Foss : (Pal : Soc :), pl : xxiii., p. 232.

*Sandalodus minor*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Quart : Journ : Geol : Soc : Vol : XL. (1884), pl : xxvi., fig : 7, p. 626 (tooth).

*Squalus* sp : (?)

Oxford Clay. Near Scarborough.

Phillips. Geol : Yorks : Pt : I., pl : v., fig : 22 (tooth—probably of *Aspidorhynchus euodus*, Egerton).

*Strophodus Rigauxi*, Sow :

Cornbrash. Scarborough.

H. M. Platnauer. Ann : Report Yorks : Phil : Soc : 1886, Pl : I., figs : 1, 2, p. 36.

*Venustodus (Lophodus) serratus*, Davis.

Yoredale Rocks. Leyburn.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl : li., figs : 23, 24, p. 408.

Quart : Journ : Geol : Soc : Vol : xl. (1884), pl : xxvii., fig : 19, p. 627 (teeth, two specimens).

*Xystrodus pulchellus*, Davis.

Carb : Limestone. Richmond.

J. W. Davis. Trans : Roy : Dublin Soc : (2) Vol : I., pl : lv., fig : 24, p. 450 (tooth).



“Jaw of Fish?”

Yoredale Rocks. Leyburn.

J. W. Davis. Quart: Journ: Geol: Soc: vol: xl. (1884),  
pl: xxvii., fig: 3, p. 634.

“Spine of Fish, sp: nov:?”

Yoredale Rocks. Leyburn.

J. W. Davis. Quart: Journ: Geol: Soc: vol: xl. (1884),  
pl: xxvi., fig: 7.

### REPTILIA.

*Ornithocheirus Reedii*, H. G. Seeley.

Lower Greensand. Cambridge.

Geol: Mag: vol: viii. (1881), pl: I., fig: 3, p. 13 (Anterior  
end of snout).

*Ornithocheirus xyphorhynchus*, H. G. Seeley.

Upper Greensand. Cambridge.

Geol: Mag: vol: viii., 1881, pl: I., figs: 2a, 2b (Lower jaw).

*Plesiosaurus homalospondylus*, Owen.

Lias (*Communis*, Zone). Whitby.

Owen. Brit: Foss: Rept: of the Lias. (Pal: Soc:) pt: III.,  
pl: viii., p. 12. (Skeleton).

*Thaumatosauros (Plesiosaurus) Zetlandicus*,\* Phil:

Lias (*Communis*, Zone). Lofthouse.

Tate & Blake. Yorks: Lias, pl: I., fig: 5, p. 249.

(Skeleton: only Fore-arm figured).

### MAMMALIA.

*Ailurus anglicus*, W. B. Dawk:

Red Crag. Felixtowe.

Prof: W. Boyd Dawkins. Quart: Journ: Geol: Soc: vol:  
xliv. (1888), pl: x., figs: 1—4, p. 228.

(Angle of rt: ramus with last molar).

*Amphilestes (Amphitherium) Broderipii*, Owen.

Stonesfield Slate. Stonesfield.

Owen. Odontography (1845), pl: xcix., fig: 3, p. 377.

Owen. Brit: Foss: Mam: (1846), fig: 19, p. 58.

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(\* Given as *Zetlandi* in the above reference).

Owen. Palæontology (Ed : 1860), fig : 85, p. 30.

Owen. Palæontology (Ed : 1861), fig : 112, p. 340.

(In both the above it is wrongly given as *Amphitherium Prevostii*).

Owen. Brit : Mes : Mam : (Pal : Soc :) Pl : I., fig : 25, p. 15.

Phillips. Geol : Oxford, fig : 80, p. 234.

Lydekker. Cat : Foss : Mam : (B. M.) Pt : V., fig : 41, p. 271.

*Castor veterior*, Lank :

Red Crag. Woodbridge.

E. Ray Lankester. Ann : Mag : Nat : Hist : XIV. (1864),  
pl : viii., fig : 6, p. 355. (Lower incisor).

(“ Neighbourhood of Sutton ” in Ann : and Mag :)

*Castor veterior*, Lank :

Red Crag. Woodbridge.

E. Ray Lankester. Ann : Mag : Nat : Hist : XIV., 1864,  
pl : viii., fig : 5, p. 355. (Left Upper premolar).

*Elephas antiquus*, Falc :

Red Clay. Trimley.

A. Leith Adams. Brit : Foss : Elephants. (Pal : Soc :)  
Part III., pl : xxvi., fig : 2, p. 179. Also figured in Ann :  
Report Yorks : Phil : Soc : 1886, pl : I, fig : 6.

(Horizontal section through tooth).

*Elephas antiquus*, Falc :

Red Clay. Trimley.

A. Leith Adams. Brit : Foss : Elephants. (Pal : Soc :)  
Part III, pl : xxvi., fig : 4, p. 179. Also figured in Ann :  
Report Yorks : Phil : Soc : 1886, pl : I., fig : 7.

(Vertical section through tooth).

*Globicephalus (Phocæna, Delphinus) uncidens*, Lank :

Red Crag. Woodbridge.

E. Ray Lankester. Ann : and Mag : Nat : Hist : (1864),  
pl : viii., fig : 13, p. 356 (tooth).

*Hyaena striata*, Zimm :

(*H. antiqua*, Lank :)

Red Crag. Felixstowe.

E. Ray Lankester. Quart : Journ : Geol : Soc : vol : xxvi.  
(1870), pl : xxxiii., figs : 5, 6, p. 511.

(3rd upper right premolar).

*Hyæna striata*, Zimm :

(*H. antiqua*, Lank :)

Red Crag. Felixstowe

E Ray Lankester. Ann : Mag : Nat : Hist : vol : xiv., 1864,  
pl : viii., figs : 7, 8, p. 358. (2nd Lower left premolar).

*Hgænarcos sivalensis*, Falc : & Caut :

Red Crag. Felixstowe.

Ann : Rep : Y. P. S., 1886, pl : i., figs : 3, 3a.

See also Quart : Journ : Geol : Soc : Vol : XXXIII. (1877),  
p. 534. (Left upper first molar).

*Mastodon Borsoni*, Hays

Red Crag. Woodbridge.

E. Ray Lankester. Quart : Journ : Geol : Soc : Vol : XXVI.  
(1870), pl : xxxiv., figs : 1, 2, p. 508 (tooth).

*Platychoerops Richardsons*, Charlesworth.

(*Miolophus planiceps*, Owen.)

London Clay. Herne Bay.

Geol : Mag : (1865) Pl : X., p. 339.

Ann : Rep : Yorks : Phil : Soc : 1889, Pl : I., fig : 1, p. 35.

*Squalodon*, sp :

Red Crag. Woodbridge.

E. Ray Lankester. Ann : Mag : Nat : Hist : Vol : I. (1864),  
pl : viii., figs : 1, 4. p. 358 (figured as tooth of *Ursus*  
*arvensis*). (Tooth).

*Trichechus huxleyi*, Lank :

(= *Trichechodon huxleyi*, Lank :)

Red Crag. Suffolk.

Quart : Journ : Geol : Soc : Vol : XXI. (1865), pl : x., fig : 2,  
p. 226 (terminal part of tusk).

*Trichechus huxleyi*, Lank :

(= *Trichechodon huxleyi*, Lank :)

Red Crag. Suffolk.

Quart : Journ : Geol : Soc : Vol : XXI. (1865), pl : x., fig : 3,  
p. 226 (fragment of tusk).



## EXPLANATION OF PLATE.

(This plate has been kindly presented to the Society by  
W. REED, Esq., F.G.S.)

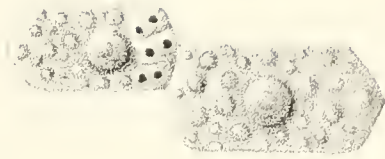
- Fig. 1. *Echinus paucimiliaris*, n. sp. Red Crag, Butley. Nat. size.  
 „ 2, 3 & 4. *Echinus henslowi*, Forbes, female form. Red Crag,  
 Walton. Fig. 2: Mag. 2 dia., side view. Fig. 3:  
 Ambactinal view: showing the depressions: mag.  
 2 dia: Brit. Mus. E 3107. Fig. 4a: enlarged plates  
 at the ambitus; 4b: plate below the ambitus.  
 „ 5. *Echinus sphæroideus*, Cotteau. Coralline Crag, Boyton:  
 [× 4 dia.  
 „ 6. „ „ „ „ Ambital plates of same  
 specimen enlarged.  
 „ 7. *Strongylocentrotus scaber*, n. sp. Coralline Crag, Aldboro'.  
 Nat. size.  
 „ 8. *Echinus woodi*, Desor. Coralline Crag, Orford. Nat. size.

Recd.  
27 APR. 92





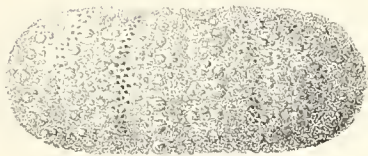
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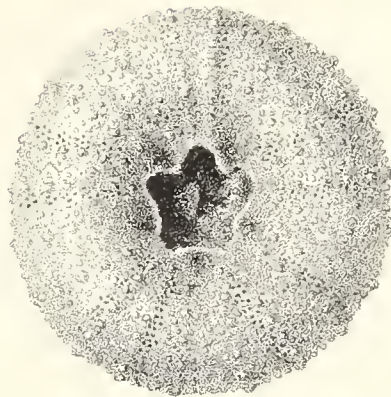
4a.



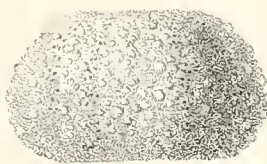
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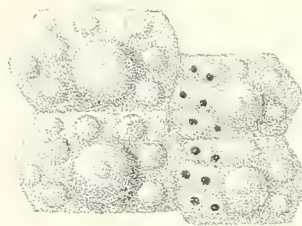
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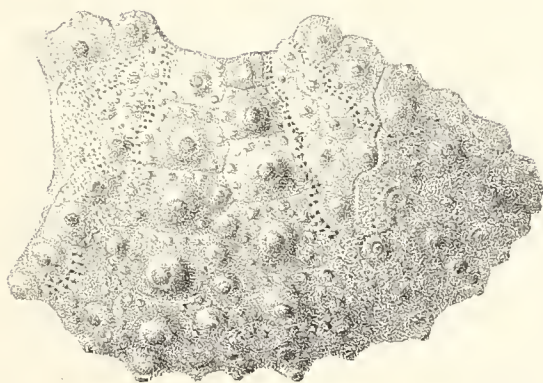
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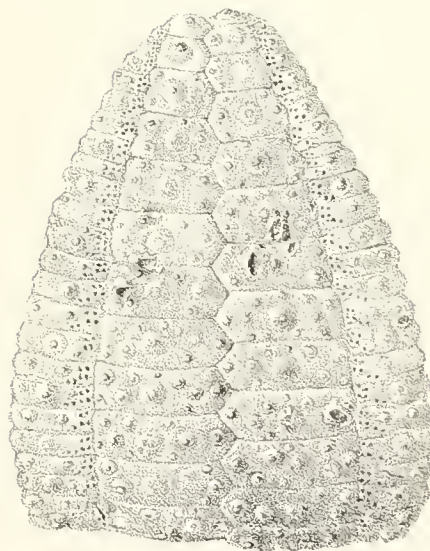
5.



6.



7.



8.

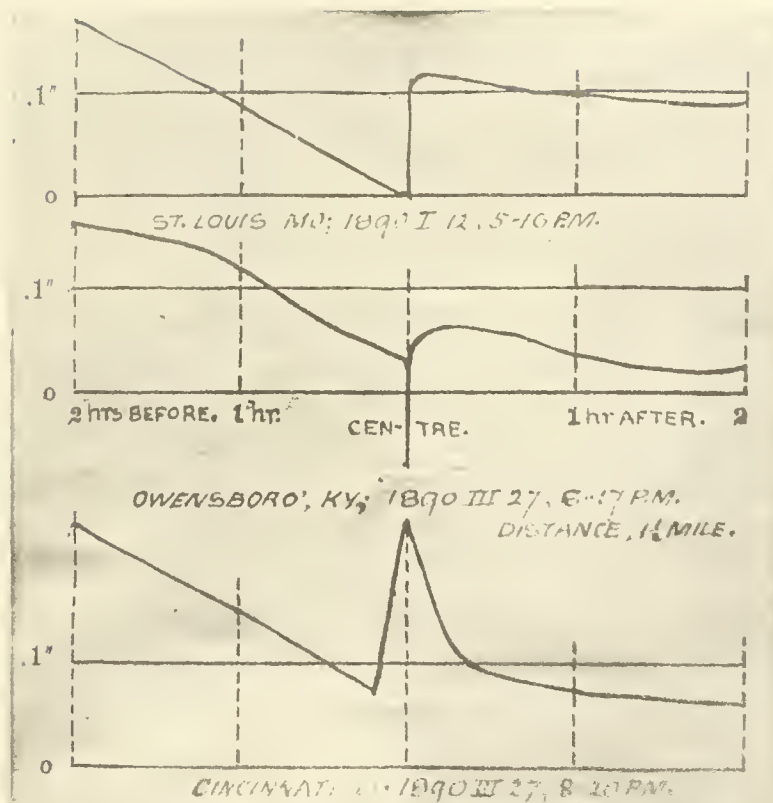
G.M.Woodward lith.

West, Newman imp.

BRITISH PLIOCENE ECHINOIDEA.

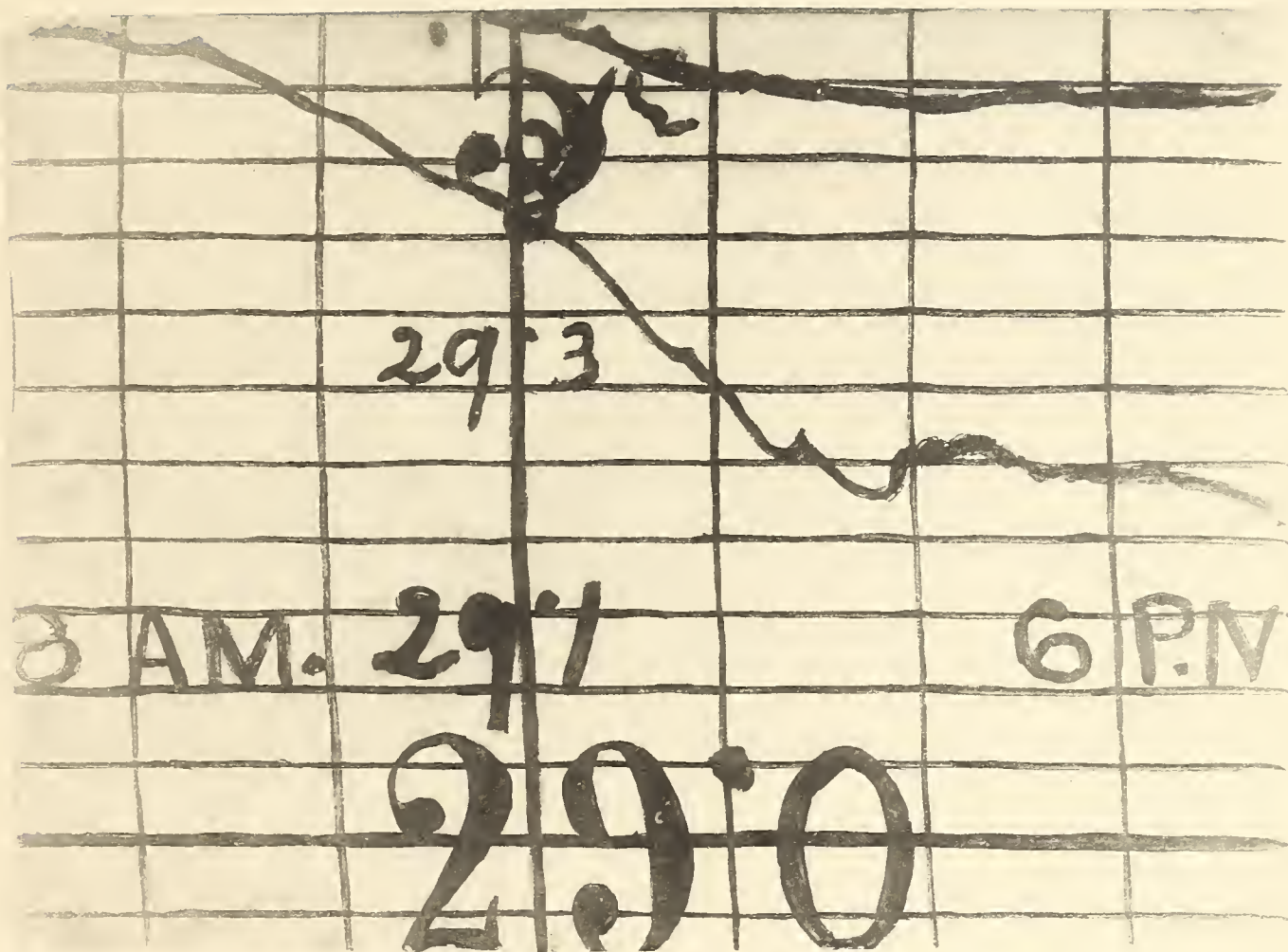






ANEROIDGRAMS,  
 AMERICAN TORNADOES.  
 From "SCIENCE" Photo J. J. A. M.





ANEROIDOGRAPH.

BOOTHAM SCHOOL, YORK, 1890, III., 8.

Distance from windrush,  $2\frac{1}{2}$  miles.

Clock, 10 mins. fast; trace, 0.1 inch too high.

Microphotographed by T. H. WALLER, B.A., B.Sc.









